Panoramic radiograph as a diagnostic tool in dentistry UNAIR-IIUM Stovit Online Series

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INTERNATIONAL ISLAMIC UNIVERSITY MALAYSIA
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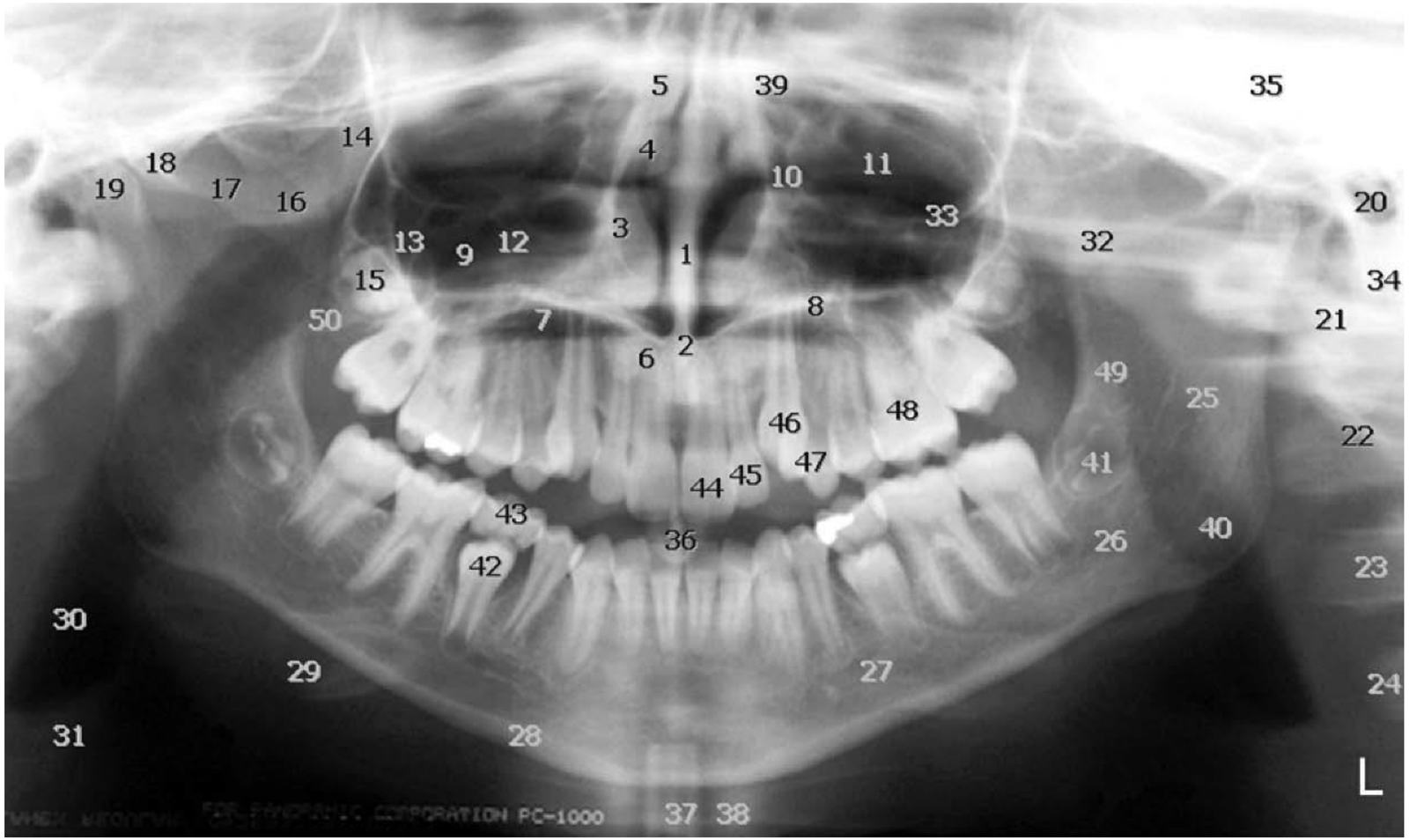
Introduction

- Kulliyyah of Dentistry IIUM located in Kuantan, Pahang, Malaysia. Around 3-4 Hours driving from Kuala Lumpur

Introduction

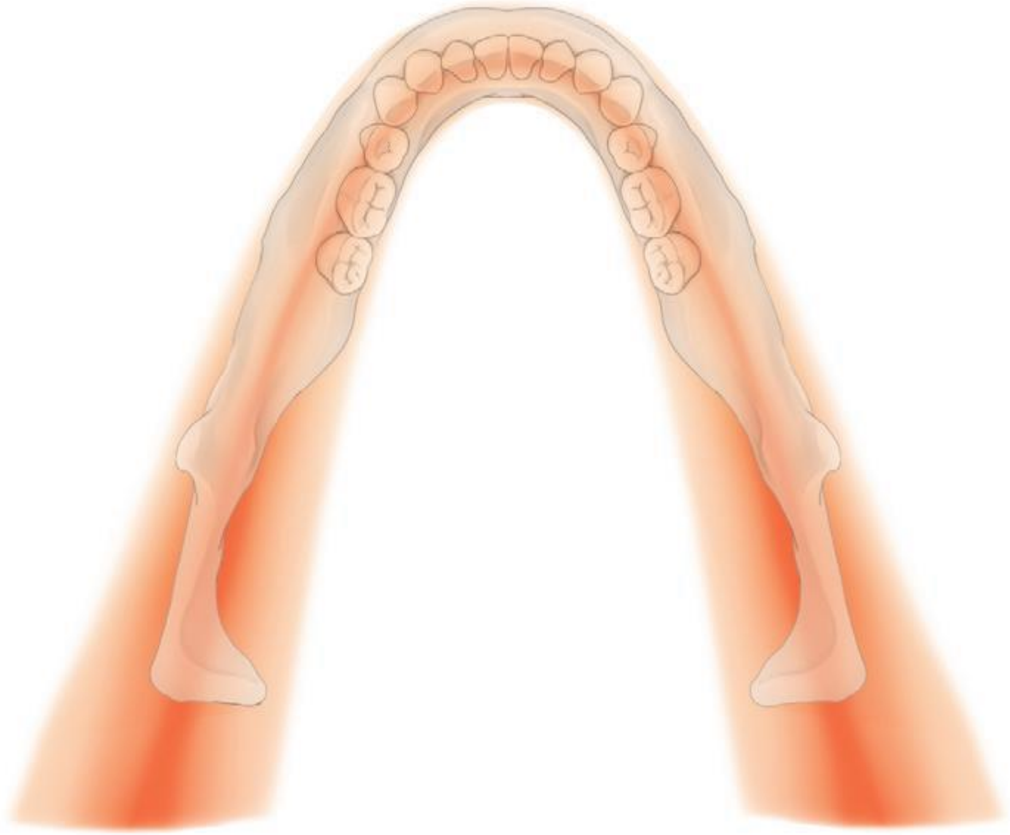


- 50 landmarks from a single pano
- Know your anatomy and pathology

- Film: need to be developed
- PSP plate: need to scan first
- Digital sensor: true digital, instant image.

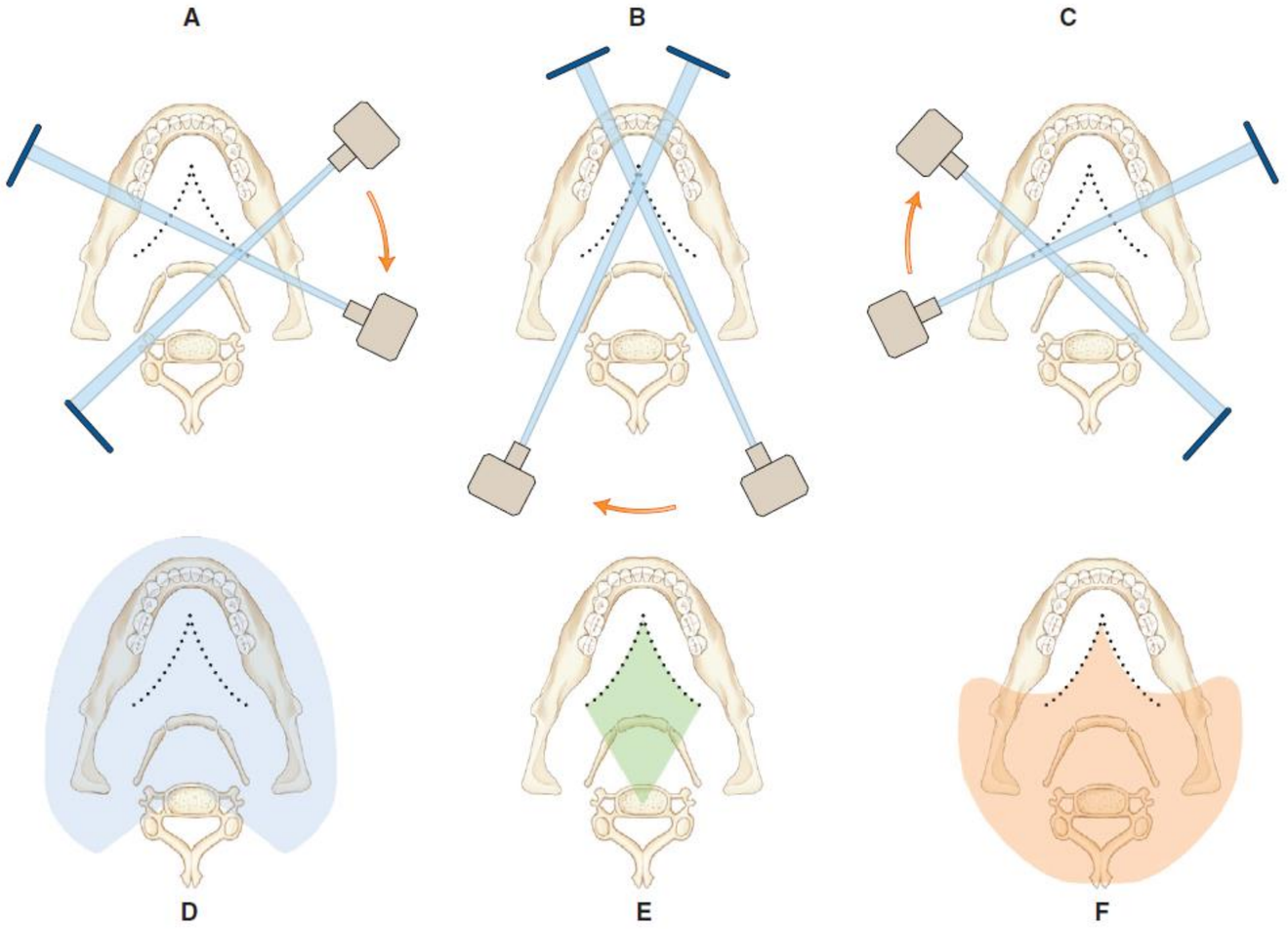
- Focal trough
- Real/ double/ ghost
- Patient positioning

Focal trough



- It is a three dimensional curved zone, or “image layer,”
- The structures lying within this zone are reasonably well defined on the final panoramic image

Real/ double/ ghost

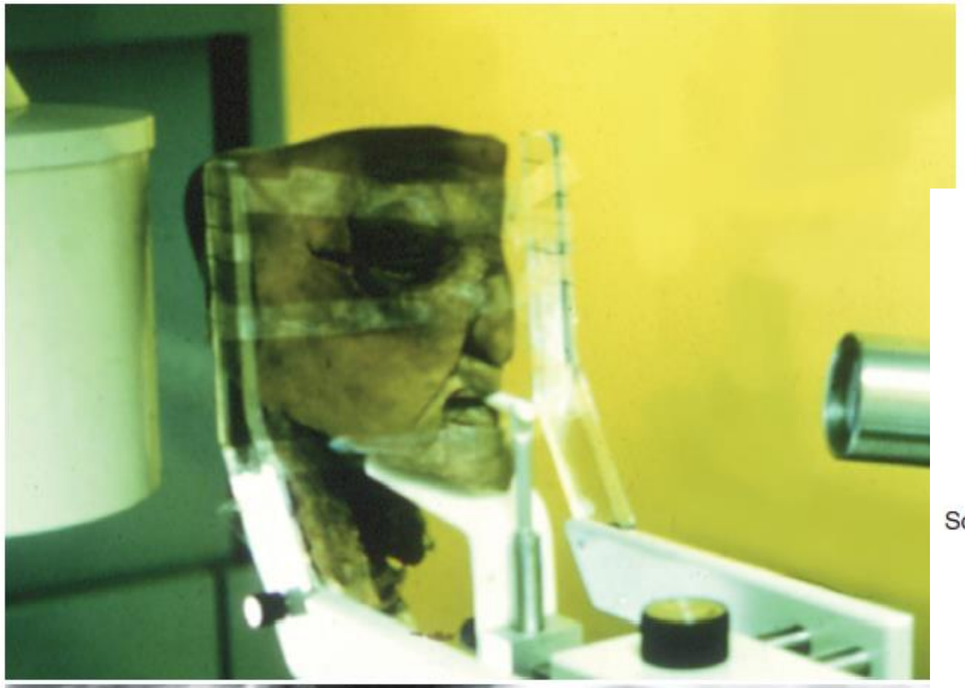


Between moving center and receptor: Real

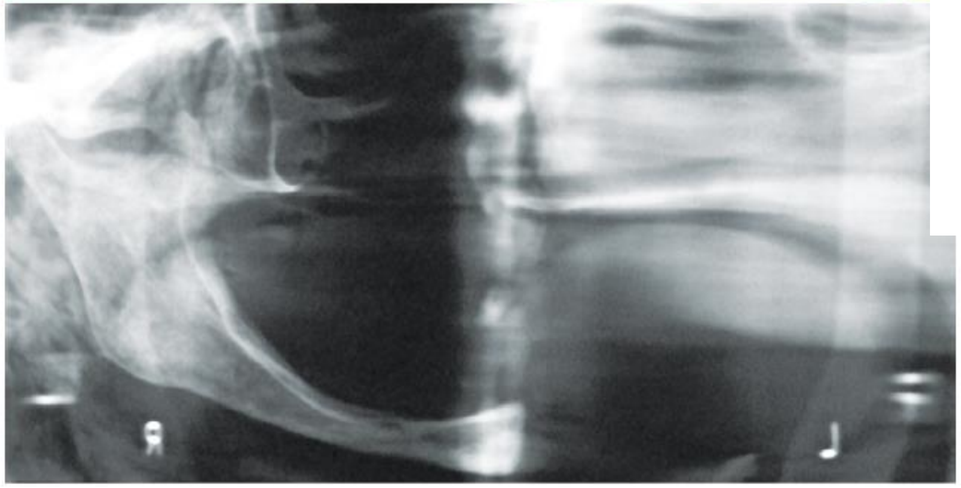
Btw moving center rotation and receptor imaged twice: Double image

Between xray source and center rotation: ghost image

A



B



C

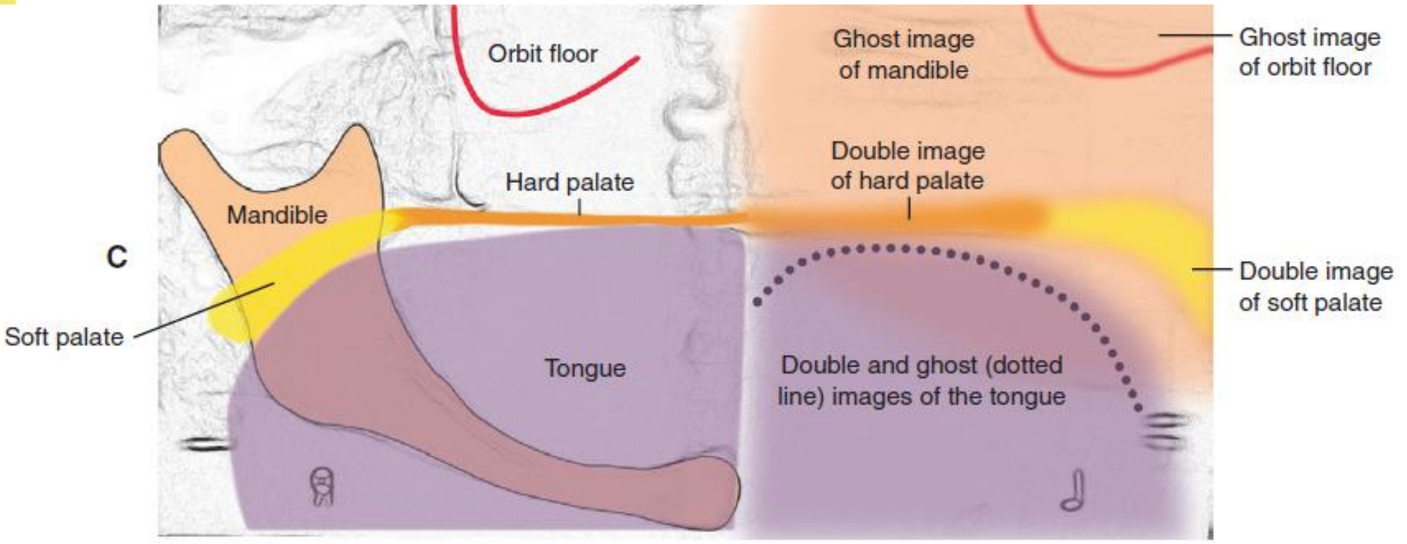


FIGURE 10-12 **A,** Half a cadaver head supported in a panoramic machine. **B,** Resulting panoramic image with real images of right-side structures and double or ghost images shown on the opposite side. **C,** Schematic representation of the real, double, and ghost images of key anatomic structures. (**A** *and* **B,** *Courtesy Dr. Barton Gratt, Redmond, WA.*)

Good quality radiograph:

- Slightly curved arc
- Similar width of ramus/ size of molars
- Covers all areas from condylar head to chin
- Maxillary anterior tooth roots not covered by hard palate

Good Quality Pano

White and Pharoah's Oral Radiology
Principles and Interpretation

Patient Positioning

Positioning

FIG. 15.15 Patient positioned in the Planmeca ProMax panoramic unit. Note the bite-peg, chin, temple supports and light-beam markers to facilitate positioning.

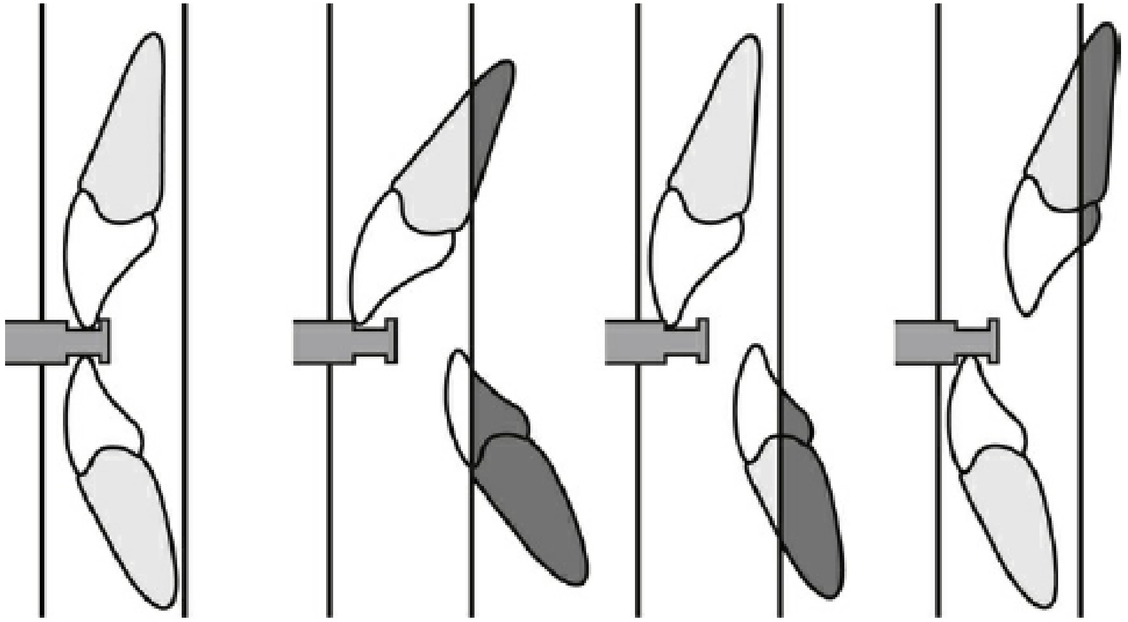
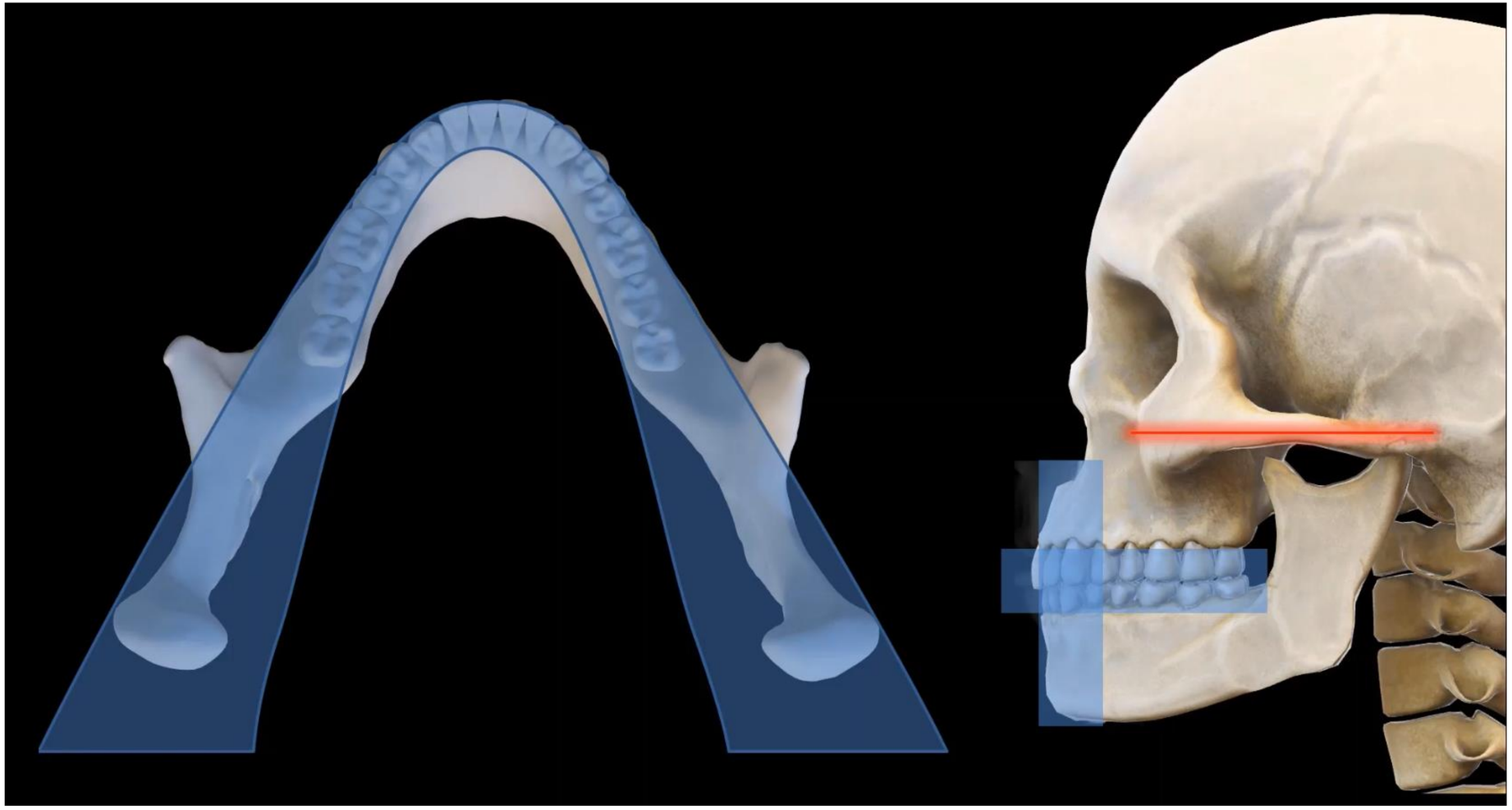
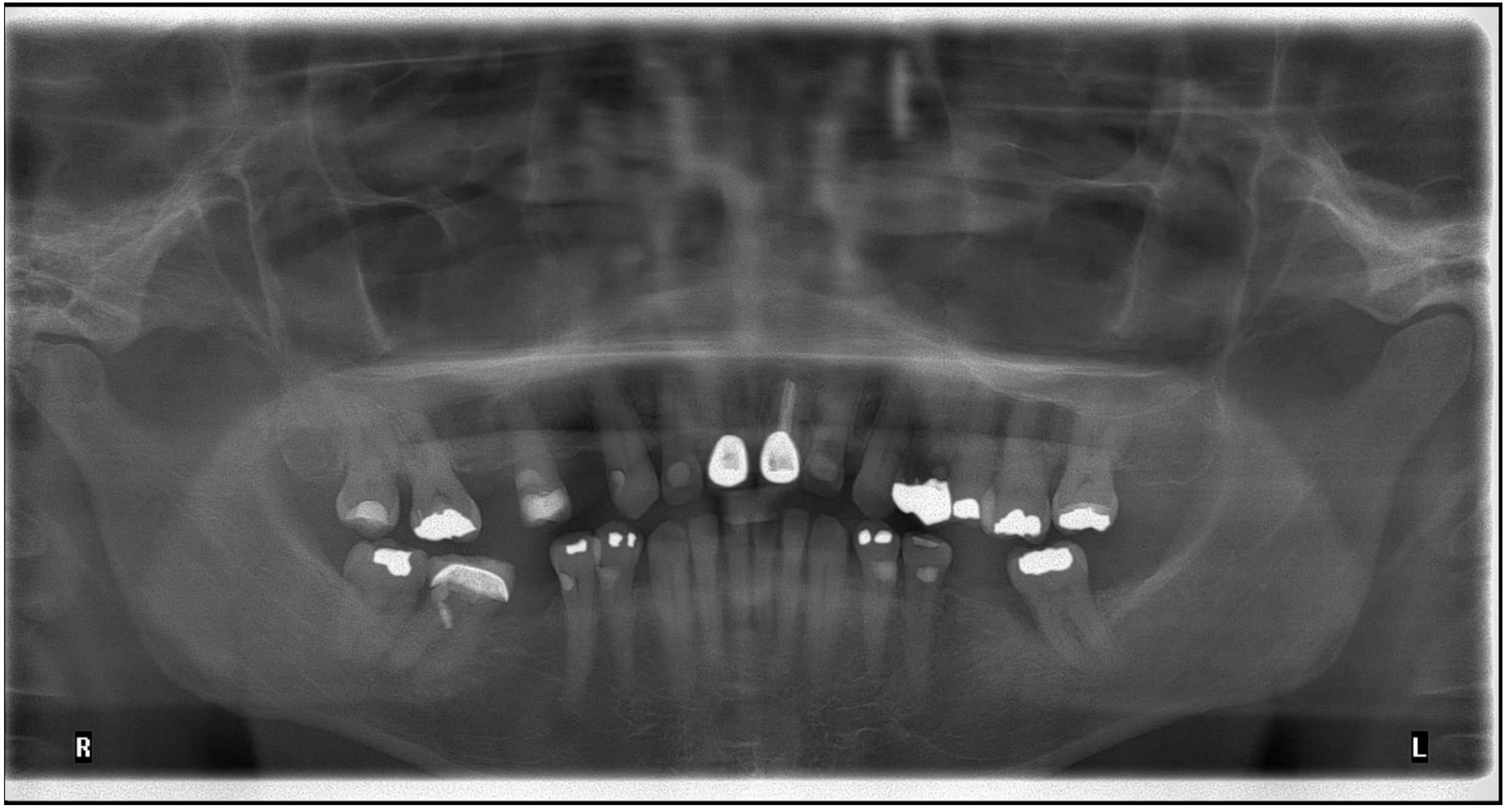


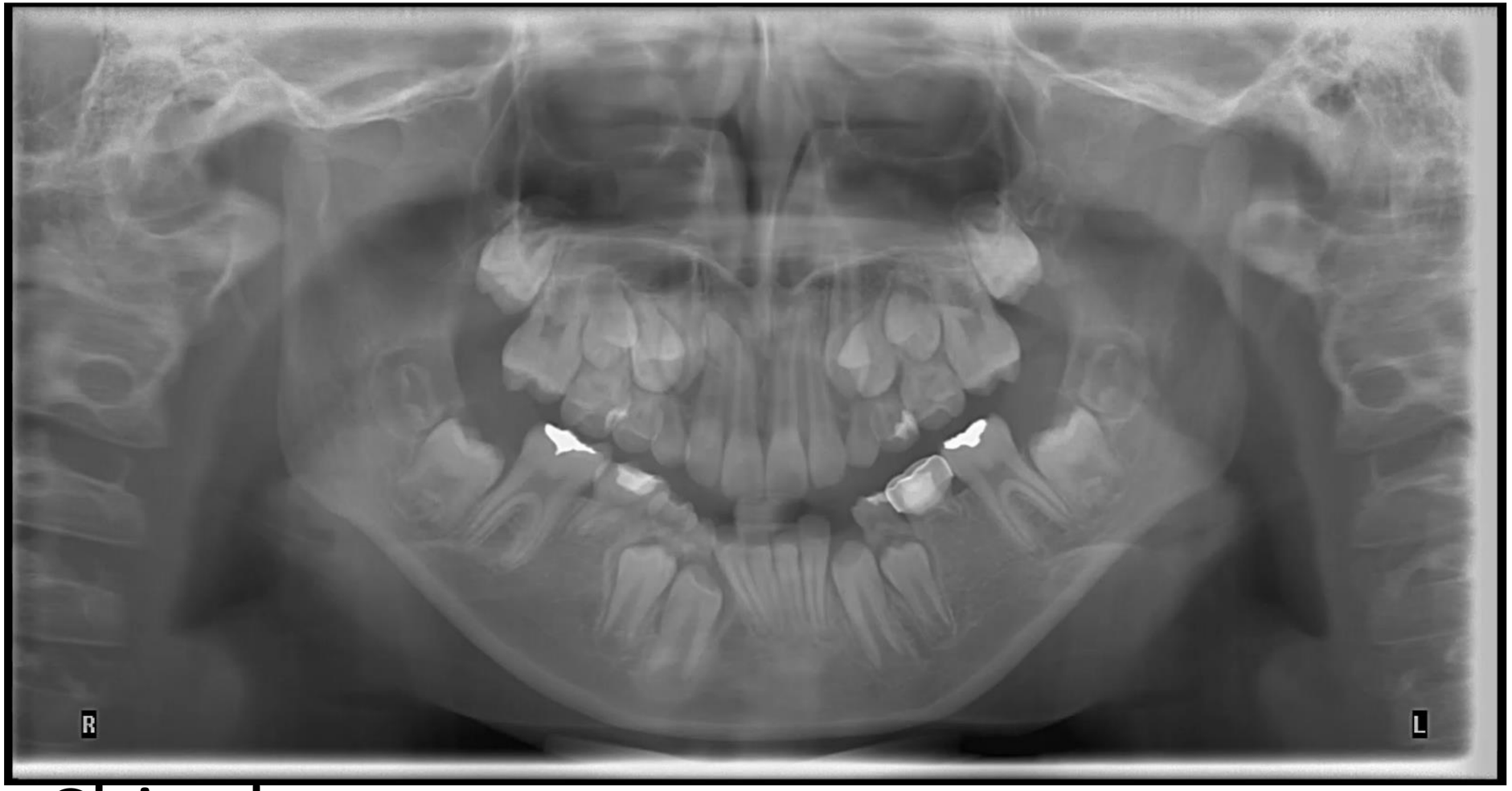
FIG. 15.17 Diagrams showing the vertical walls of the focal trough in the incisor region and the relative positions of the teeth with different underlying dental or skeletal abnormalities. (**A**) Class I. (**B**) Gross class II division 1 malocclusion with large overjet. (**C**) Angle's class II skeletal base. (**D**) Angle's class III skeletal base. The shaded areas outside the focal trough will be blurred and out of focus.

Frankfort Plane



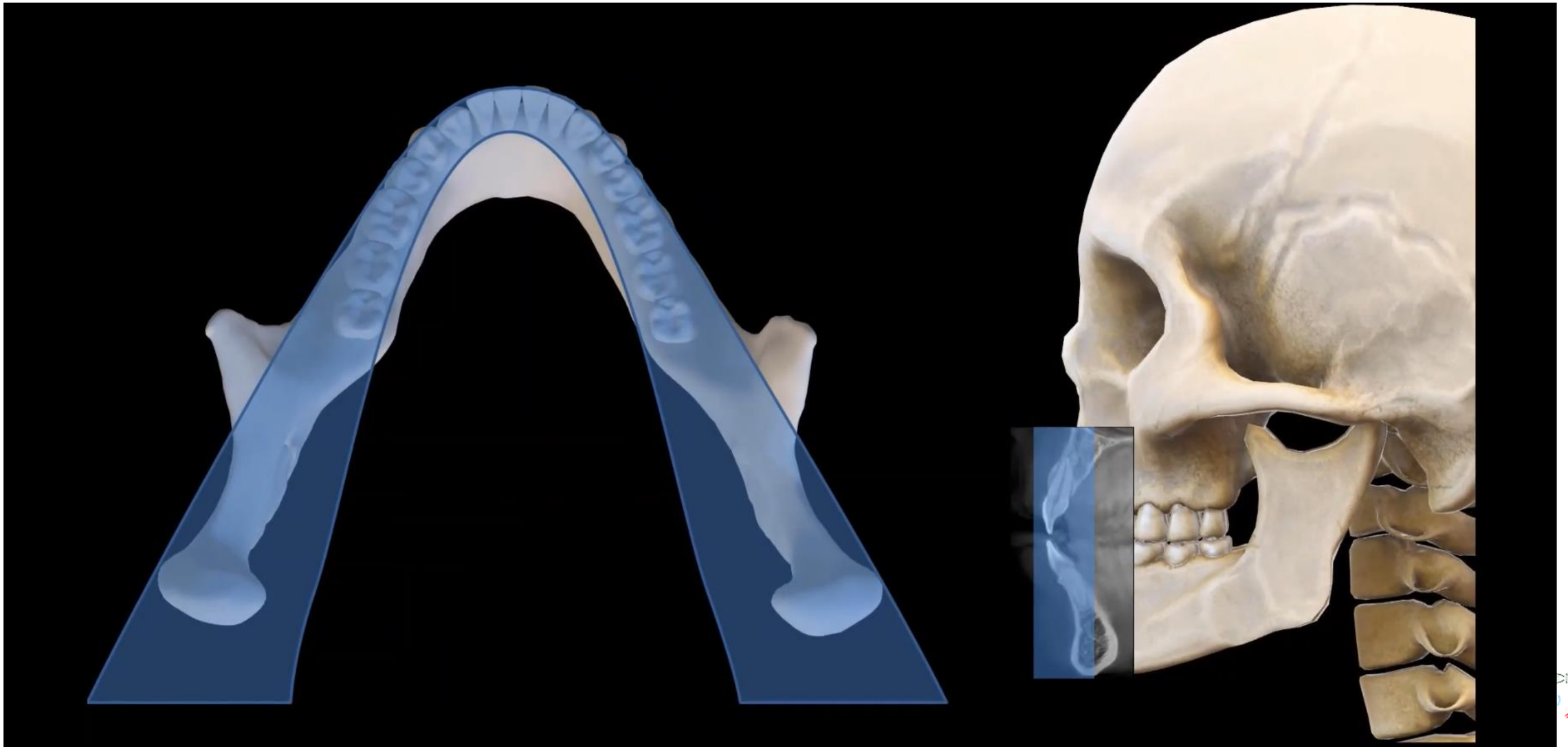


- Chin up

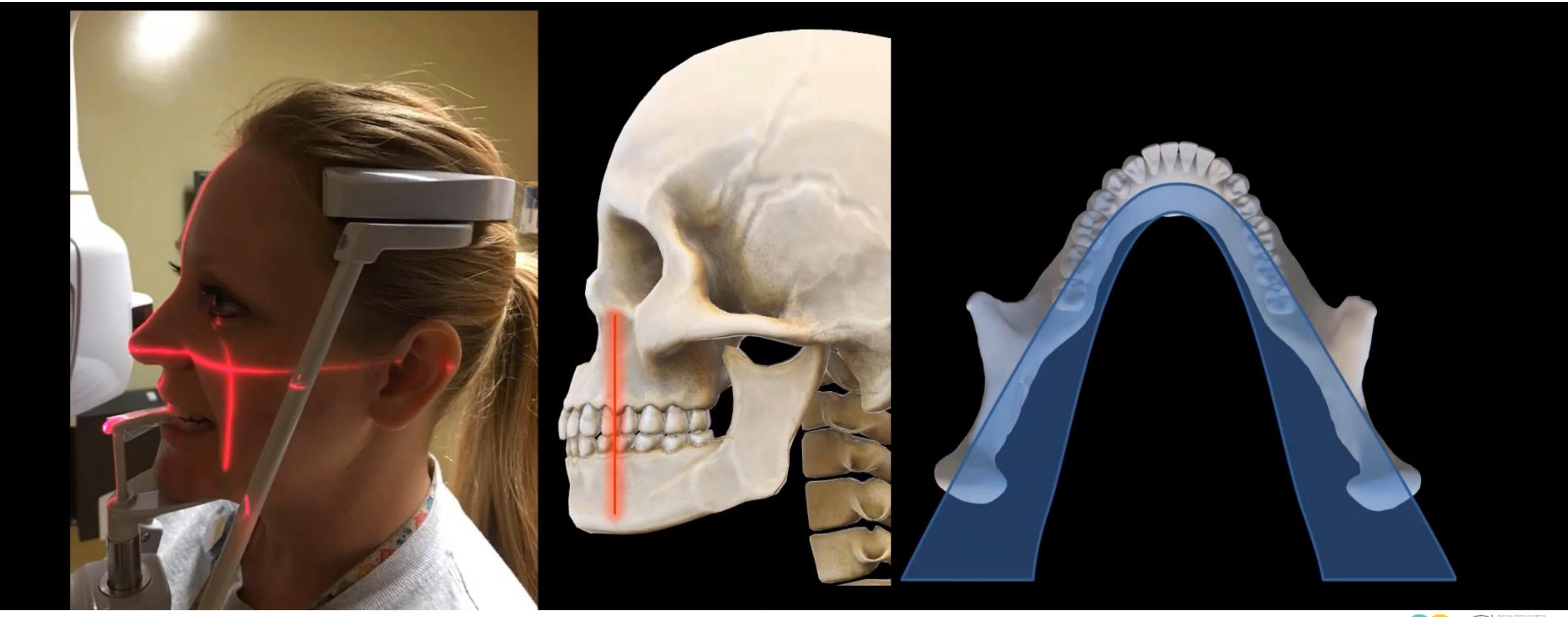


- Chin down

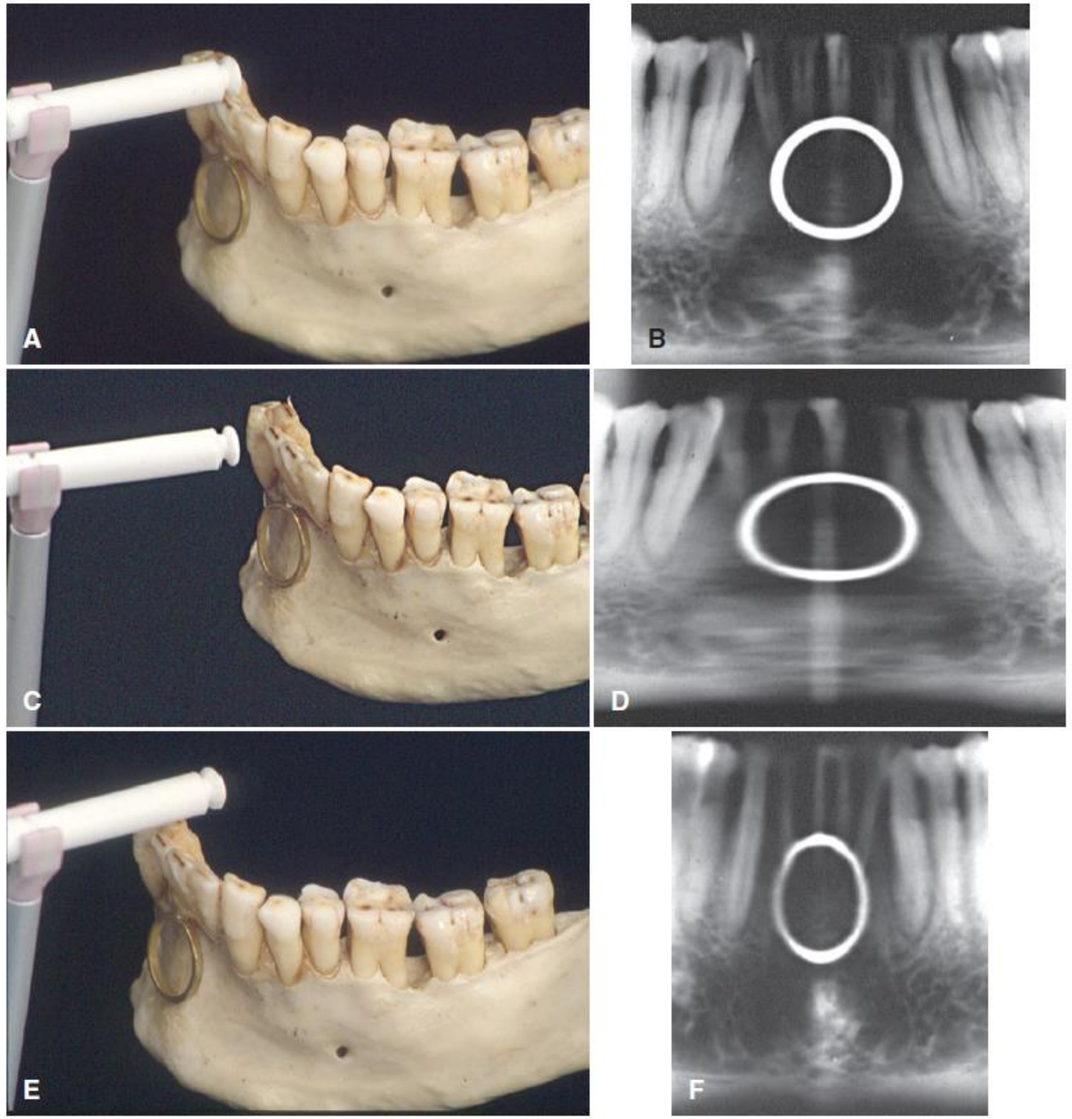
Canine guidance: to get anteriors in focus

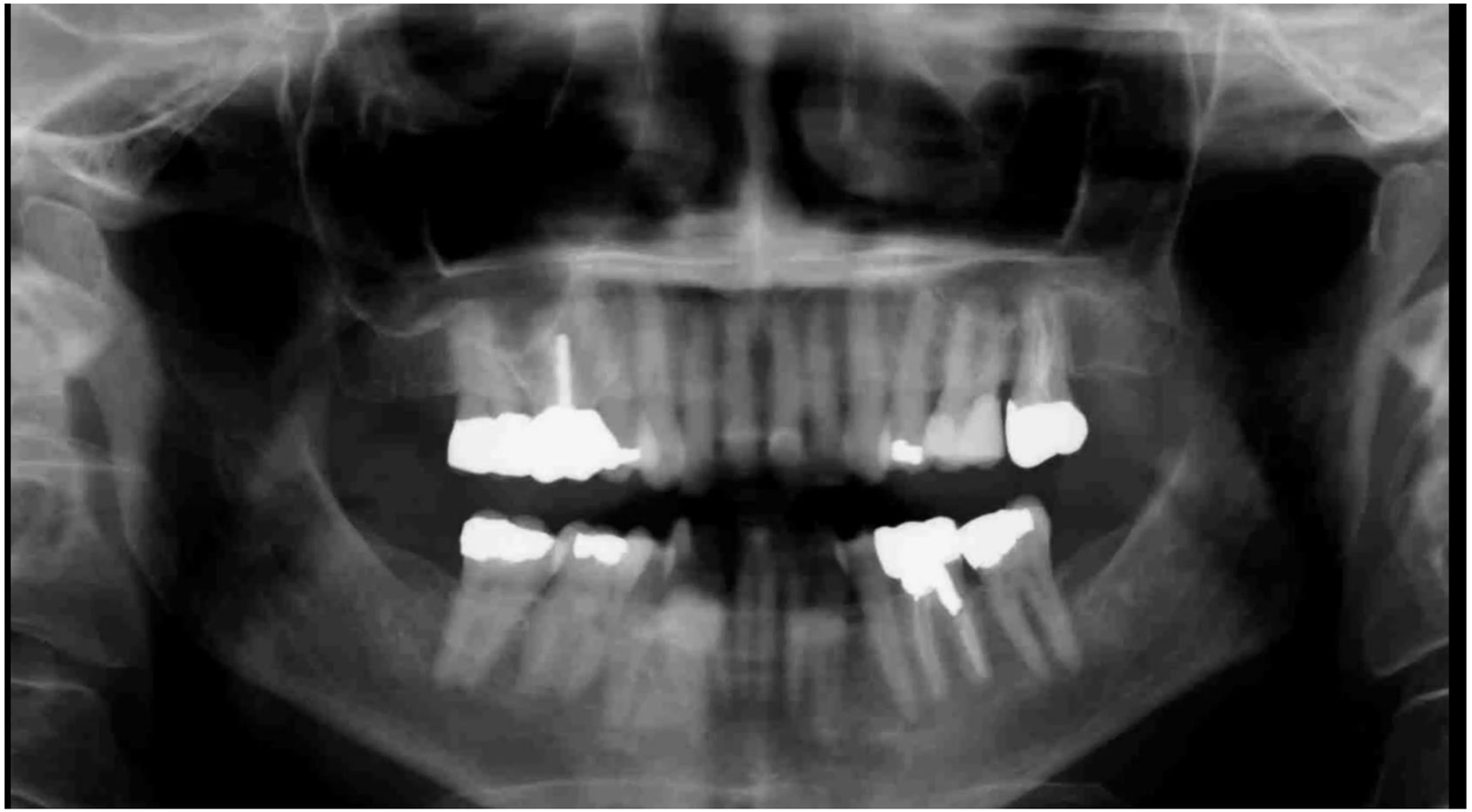


Patient forward:



Canine guidance/ anterior positioning

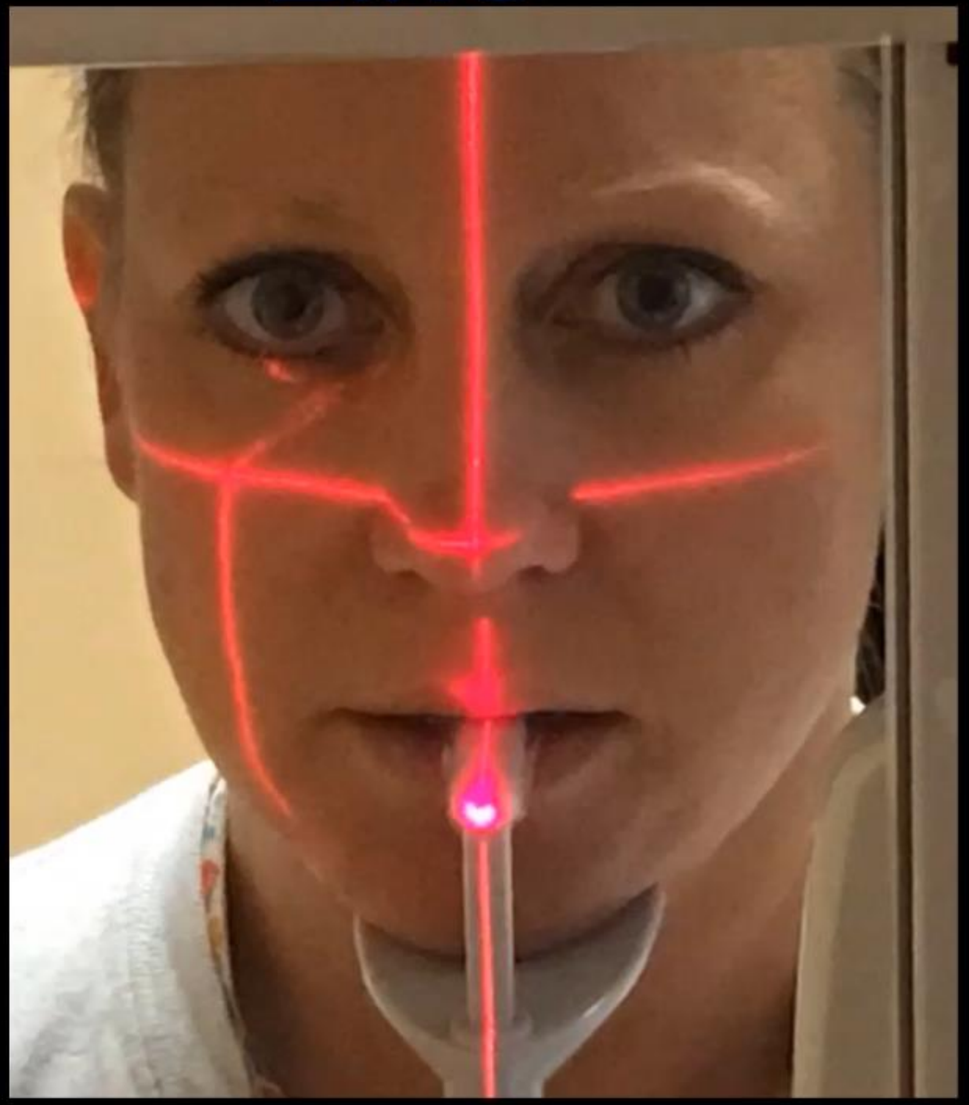


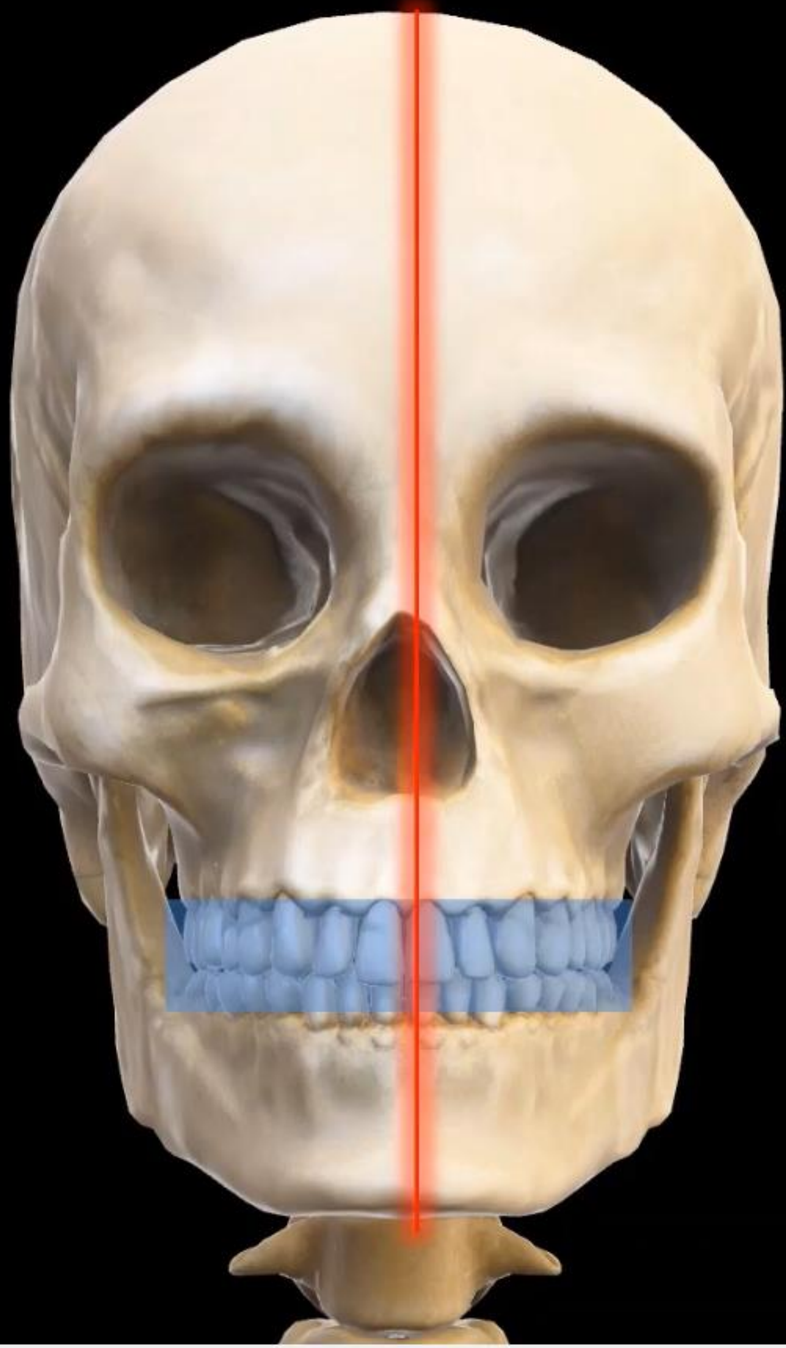


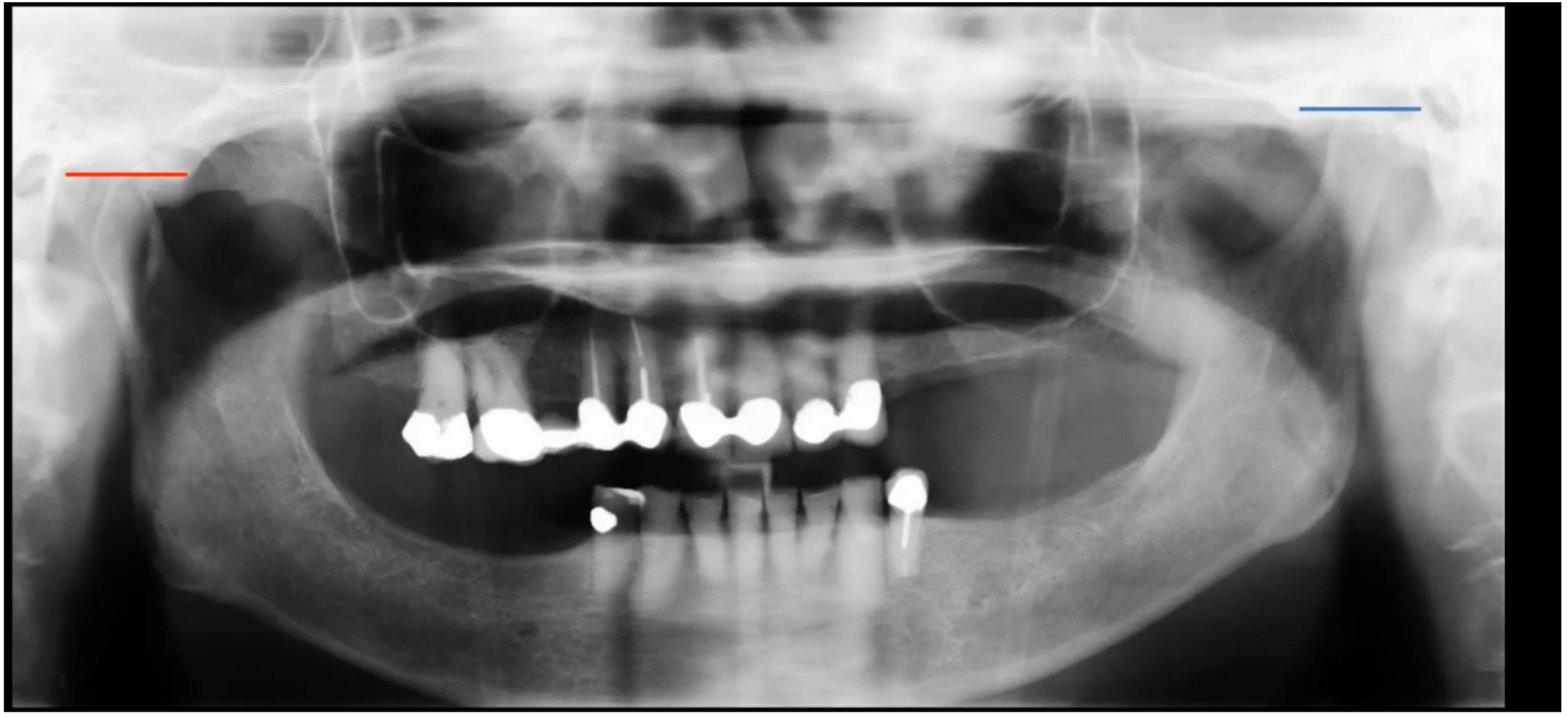
- Too forward: thin teeth

- Too backward: magnified anteriors

The Midsagittal Line





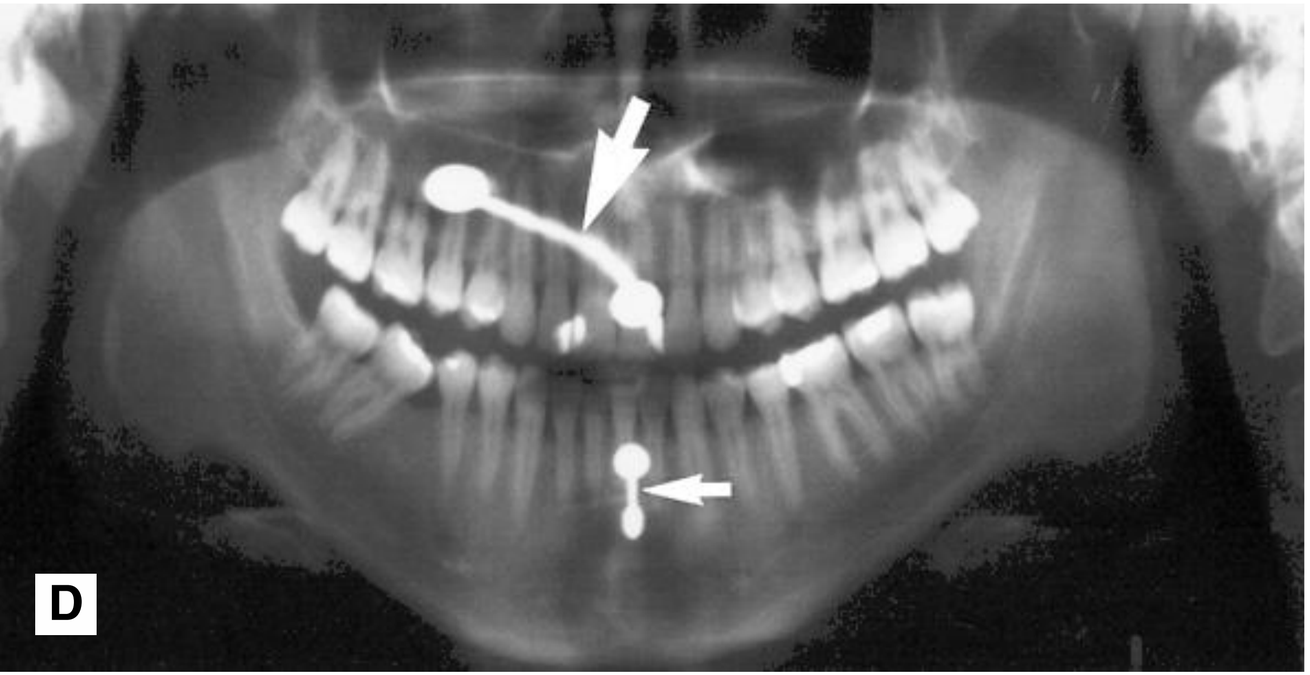


- Tilt

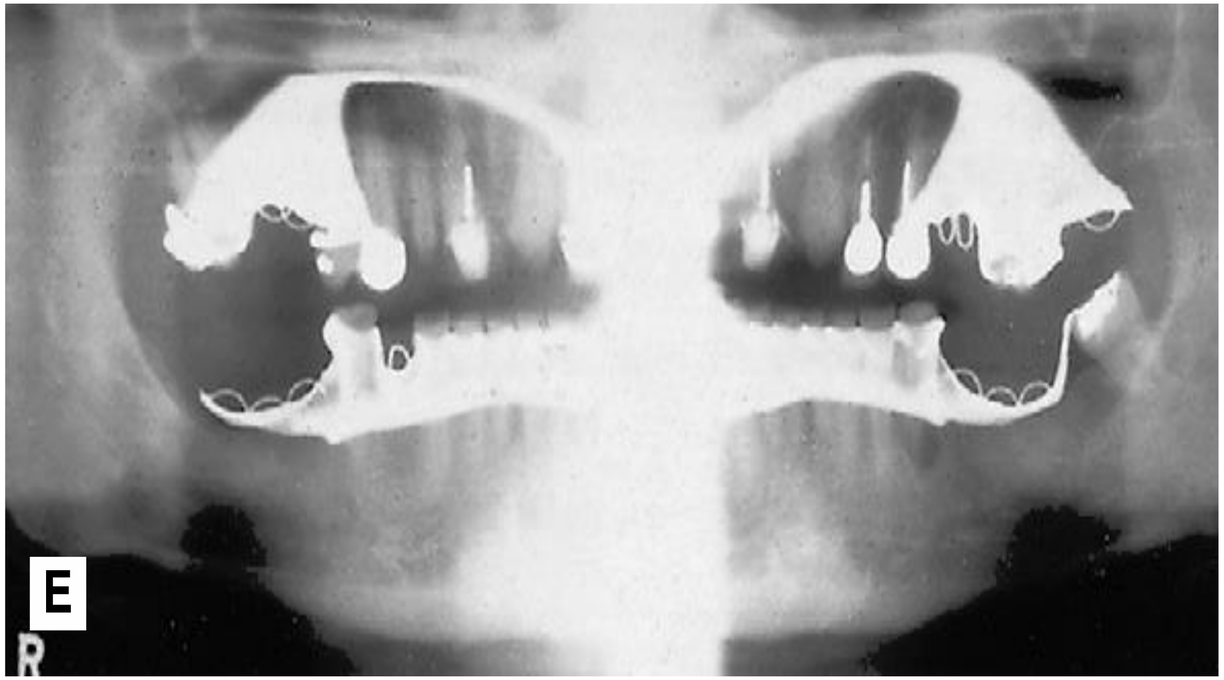
- *Patient preparation errors*
  - Failure to remove jewellery
    - Earrings, Necklaces, Piercings
  - Failure to remove dentures
  - Failure to remove orthodontic appliances
  - Failure to remove spectacles
  - Inappropriate use of the lead apron.

- *Equipment positioning errors*
  - Failure to set height adjustment correctly
  - Failure to select correct exposure settings
  - Failure to use the cassette correctly

Examples of common patient preparation errors.

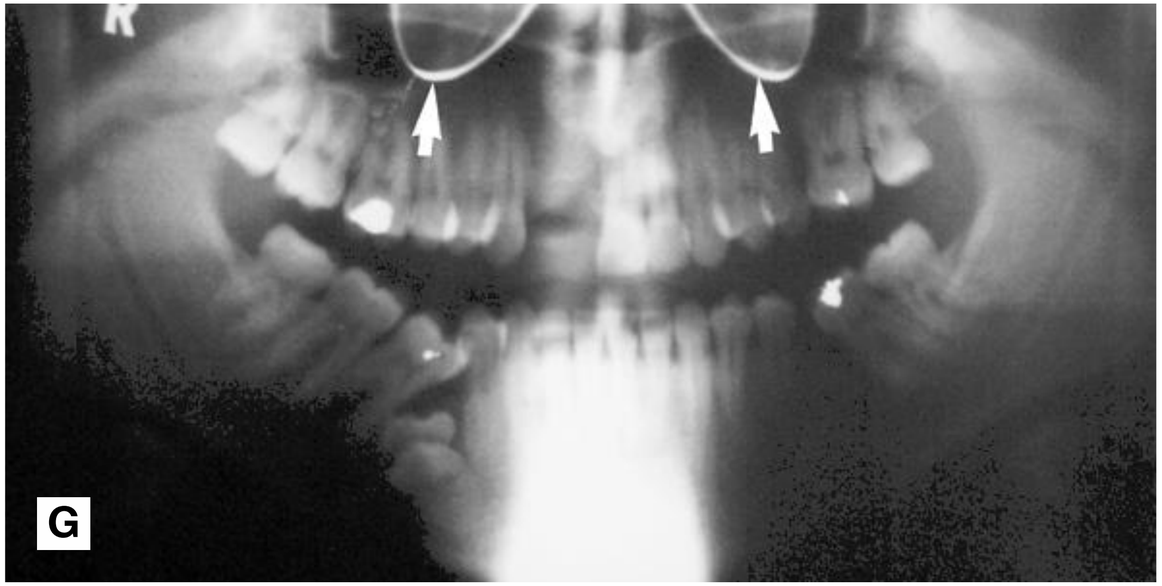


Failure to remove piercing in the tongue (large arrow) and lower lip (small arrow)



Failure to remove upper and lower metallic partial dentures.

Examples of common patient preparation errors.

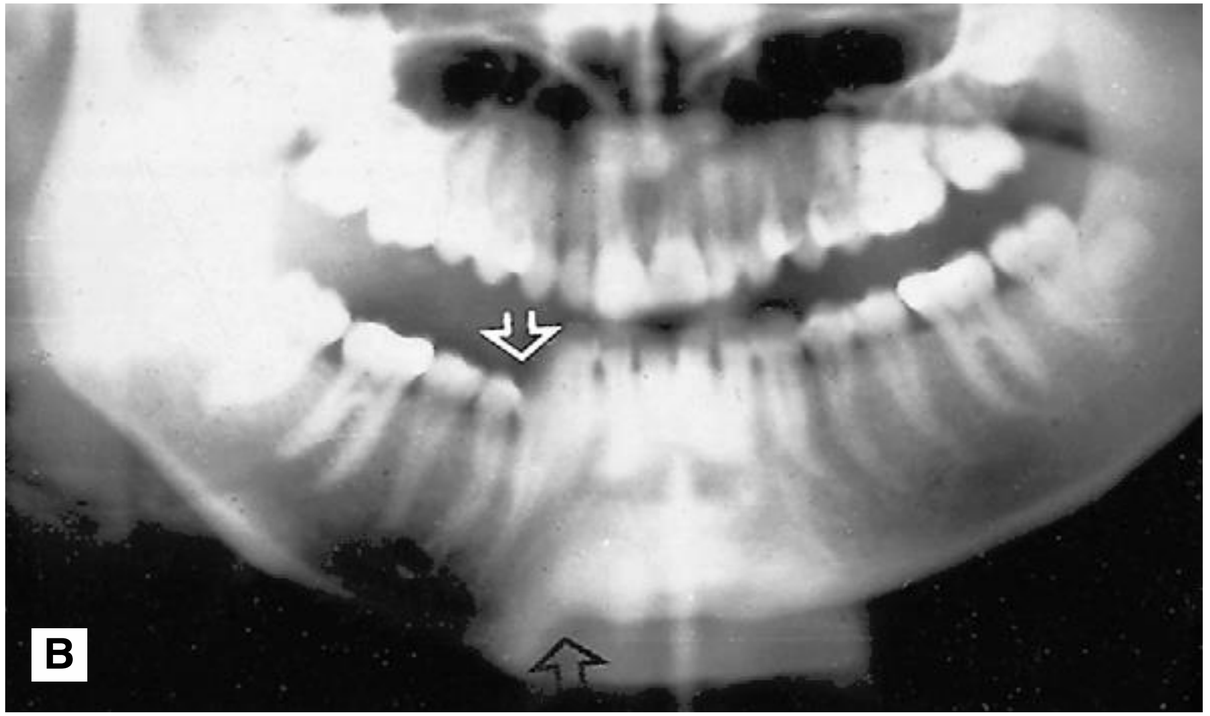


Failure to remove spectacles (arrowed)

Inappropriate use of a protective lead apron – too high on the neck casting a dense radiopaque shadow (arrowed) over the anterior part of the mandible.

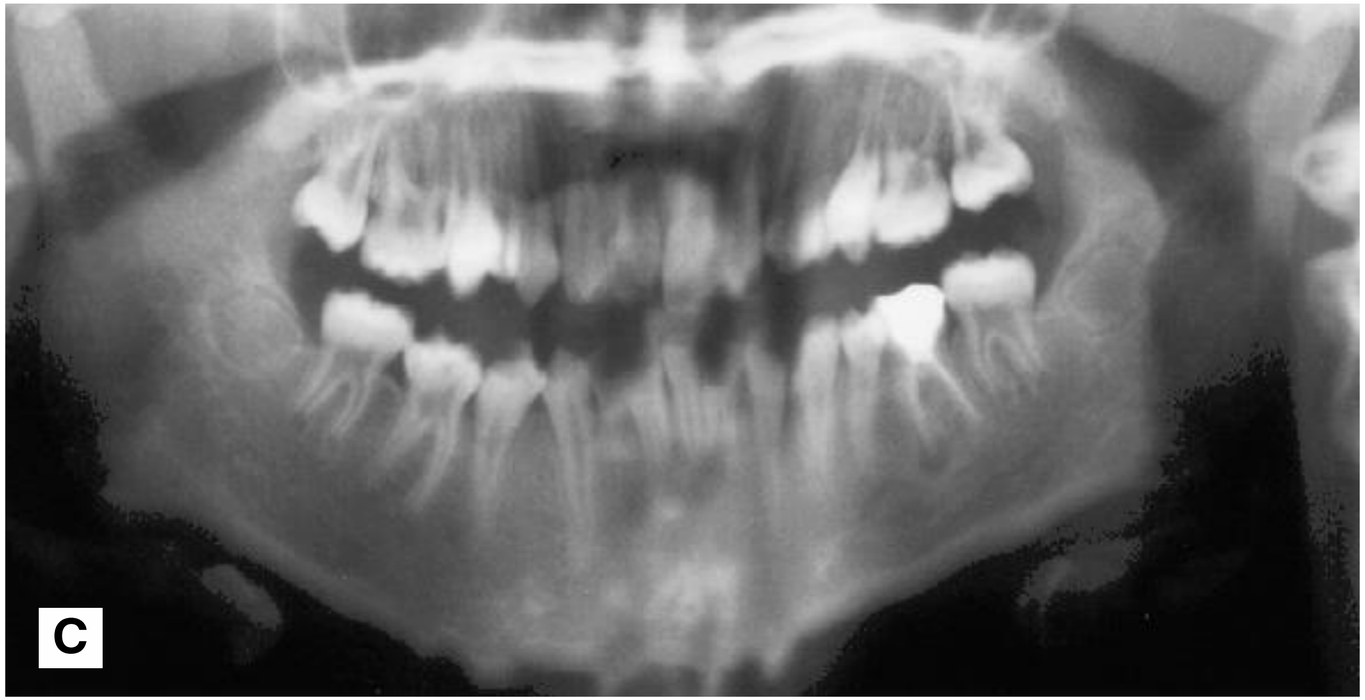
Examples of failure to instruct the patient to keep still during the full panoramic cycle

Sudden movement in the vertical plane – distortion of the image 45 region creating a step-deformity in the lower border



Movement in the vertical plane caused by the patient opening their mouth causing distortion in the 43 region (arrowed).

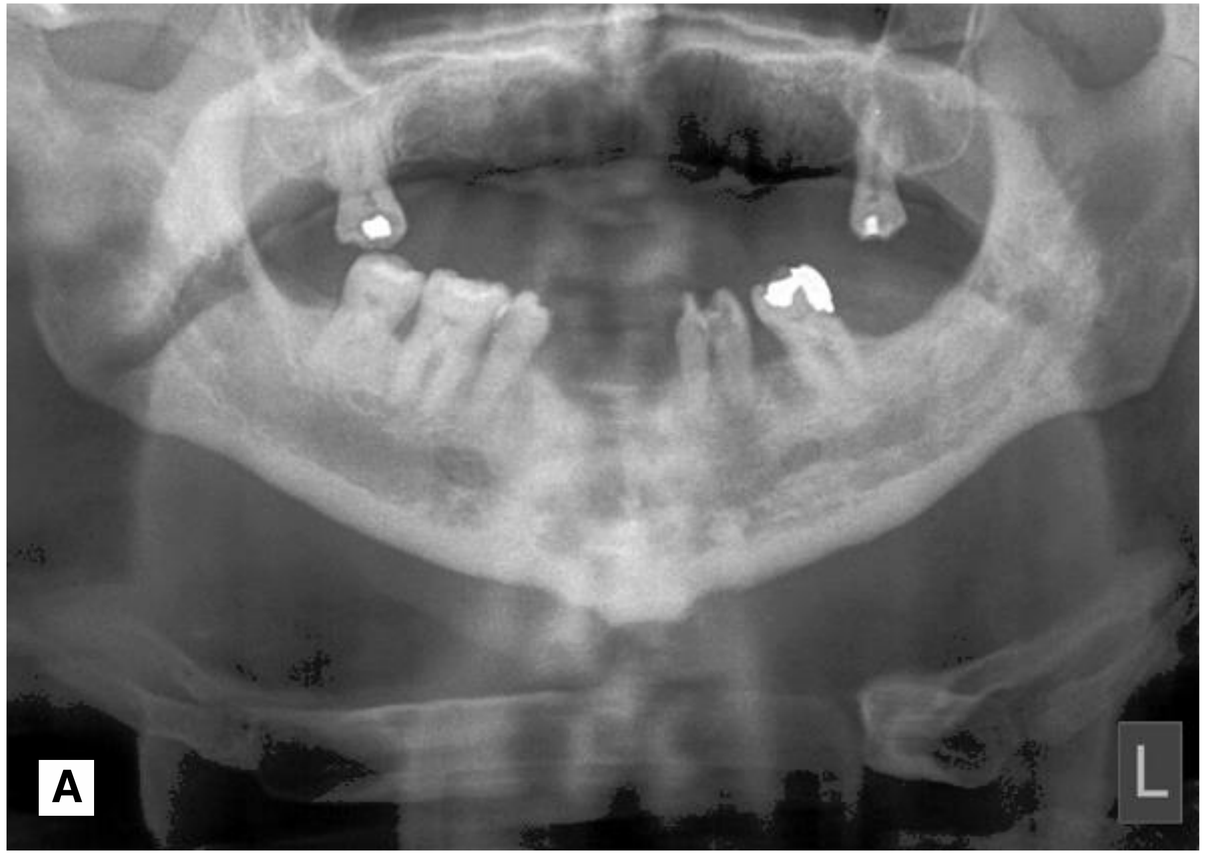
Examples of failure to instruct the patient to keep still during the full panoramic cycle



Multiple vertical movements while the anterior teeth were being imaged.

Continuous shaking movements throughout the cycle

Examples of equipment positioning errors



The X-ray tubehead and image receptor carriage assembly positioned too low relative to the patient – the antra and condyles are not imaged.

Cassette inadvertently used twice and double-exposed.

Panoramic Interpretation

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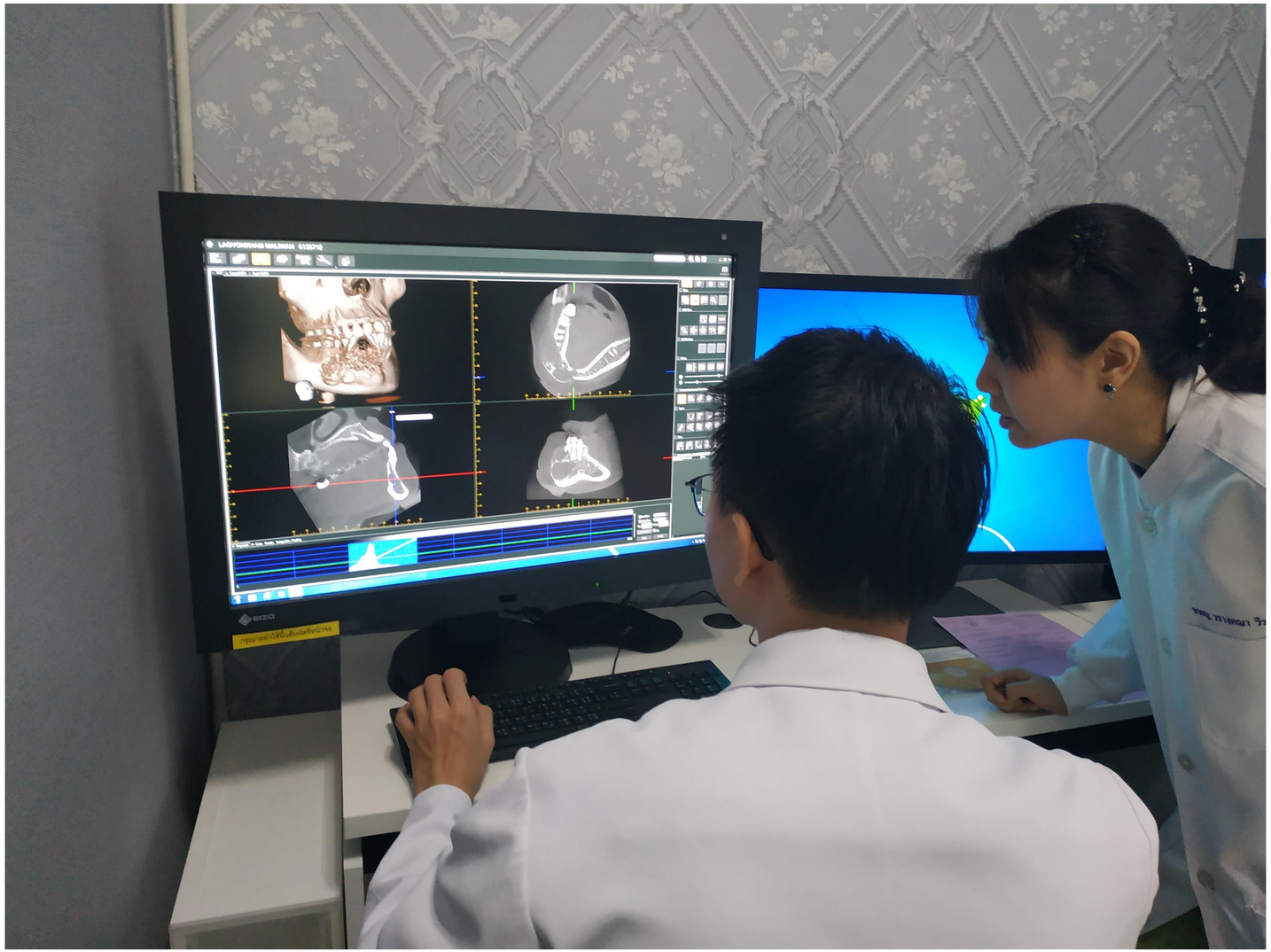

- Ghazali, AB. Interpreting panoramic radiographs for beginners. *BDJ Student* **27,** 49 (2020). https://doi.org/10.1038/s41406-020-0144-8

INTERPRETING PANORAMIC RADIOGRAPHS FOR BEGINNERS

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Introduction

Panoramic radiography is widely used in dentistry and was considered a significant breakthrough as both jaws, together with the dentition, are imaged with a quick and straightforward procedure.[1] It has a wide variety of uses requiring broad coverage of the jaws, including traumatic fractures, impacted third molars, dental problems or bony diseases, evaluation of tooth development, temporomandibular joint pain and other anomalies.[2] Distinct soft tissue, bony landmarks from midfacial to the chin region as well as the teeth can be seen in the radiograph.[3] Interpreting panoramic radiographs may be tricky especially for beginners, and this article will discuss the steps needed to read the wide sized black, white and grey images.

Step 1: Assess the quality of the radiograph

Only good quality radiographs can be used for diagnosing dental-related problems. Poor quality radiographs are mainly caused by poor patient positioning and when patient's tongue was not held against the palate.[4] A dental student or a dentist should eyeball the panoramic radiograph making sure that the occlusal plane has a slightly curved arc, similar width of ascending ramus on both sides and a similar level of ghost shadow of the mandibular angle.[5] All areas of interest from the condylar head to the chin should be included in the image and the maxillary dentition roots should not be superimposed on the hard palate. Living in the digital age, some enhancement can be done to improve the image quality of the panoramic radiograph to aid visual examination and diagnosis. This enhancement is usually done by increasing the contrast and adjusting the brightness.[4]

Step 2: Know your normal anatomy

A good dentist should know the anatomy of the head and neck region by heart. Normal anatomy, double images, ghost images, and pathology must be categorised before formulating the diagnosis.[2,5]

Step 3: View the radiograph in a sequenced, systematic approach

Several methods of reading the radiographs are described in the literature, either from left to right, top to bottom or spiral from outer border to the centre areas. A more preferred systematic approach for a beginner is the spiral method, with three swipes to cover the whole area. The first spiral begins at the right condyle, moving down along the border of the mandible and up to the left condyle. Then, move anteriorly assessing the left maxillary antrum, the hard palate, nasal area and right maxillary sinus. The second spiral begins at the right sigmoid notch area, then focuses on the periapical region of the mandibular teeth and continues with the periapical area of the maxillary teeth. The last part focuses on each tooth and alveolar bone area.[5] A systematic approach is essential to ensure all areas are covered in your interpretation and diagnosis.

How to interpret the radiograph?

Once you have examined the radiograph thoroughly, and are able to identify normal anatomy, artefacts and pathology, another systematic approach in deducing the diagnosis is needed.[6] Always compare the right side and the left side when an abnormality is detected because normal anatomic variation commonly occurs bilaterally.[7]

1. Describe the location of the lesion
2. Describe the internal structure of the lesion: radiopaque or radiolucent
3. Describe the size, shape and border of the lesion
4. Describe the effect of the lesion to the surrounding structures.

Once the four steps have been undertakn and have we ruled out that the area of interest is not a variation of normal anatomy, we can move to deducing the diagnosis of the lesion by categorising it into developmental or acquired pathology. Several categories of diseases include cysts, benign or malignant tumours, inflammation, bony dysplasias, vascular abnormalities, metabolic disorders or trauma.[6] Always try to correlate the radiographic findings with clinical details to get the best differential diagnosis.

With the brief steps of a systematic approach on the interpretation of panoramic radiographs, hopefully, it this can be a guide for all beginners in describing a radiographic image and recording a probable differential diagnosis in the patient's notes. A lot of practice with this systematic approach will help boost confidence when interpreting radiographs.

References

1. Rushton VE, Horner K. The use of panoramic radiology in dental practice. *J Dent* 1996; 24: 185-201.
2. Mallya S M, Lurie A G. Panoramic Imaging. In: White SC, M.J. P, editors. Oral Radiology: Principles and Interpretation. 7th ed. St. Louis, MO: Mosby; 2014. p. 166-184.
3. Farman A G, Clark S J, Friedlander A H, Jacobs W R, Khan Z, Kushner GM, et al. Panoramic radiology: Seminars on maxillofacial imaging and interpretation. 2007. p. 1-231.
4. Gross H, Nilsson M, Hellen-Halme K. Detectability of normal anatomy in digital panoramic radiographs. *Swed Dent J* 2014; 38: 179-185.
5. Bolas A. Reading a panoramic radiograph. *Ir Dent J* 2014; 60: 190-191.
6. Baghdady M. Principles of Radiographic Interpretation. In: White SC, Pharoah MJ, editors. Oral Radiology: Principles and Interpretation. 7th ed. St. Louise, MO: Mosby; 2014. p. 271-284.
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https://doi.org/10.1038/s41406-020-0144-8

Radiographic Interpretation

Need to have systematic approach when viewing the radiograph for interpretation

Save the tooth part in the last step.

4 steps

Step 1: Assess the quality of the radiograph

Step 2: Know your normal anatomy

Step 3: View the radiograph in a sequenced, systematic approach

Step 4: Formulate diagnosis

View the radiograph in a sequenced, systematic approach

- Cover the whole area in the radiograph! From condyle to chin.
- Spiral technique
- Outside-inside technique
- Save the tooth area for the last part

- Go systematically:

1. periphery and corners of the pano
2. mandibular outer cortex
3. maxilla cortex
4. zygomatic bone and arch
5. maxillary sinus
6. nasal cavity and palate
7. maxilla/mandible bone pattern
8. then go to the dentition/ alveolar bone

Interpret the radiograph

- If pathology/lesion detected; always compare left/right.
- Describe the pathology:

1. Location of the lesion
2. Internal structure of the lesion: radiopaque or radiolucent
3. Size, shape and border of the lesion
4. Effect of the lesion to the surrounding structures.

- Formulate diagnosis together with clinical information

Location

- Localized or generalized?
- Location:
- Relationship with tooth
- Above the IAC?
- Anterior/posterior?

Internal structure

- Radiolucent or radiopaque, or mixed
- Trabecular pattern; eg: fibrous dysplasia with ground glass appearance
- Septation: unilocular or multilocular
- Calcification

Border

- **Well defined:**
- Punched out
- Corticated: mostly cyst/ benign tumour
- Sclerotic: very slow rate, eg: periapical osseous dysplasia
- Radiolucent line with corticated border. Eg: odontoma, cementoblastoma
- **Ill defined: blending or invasive**

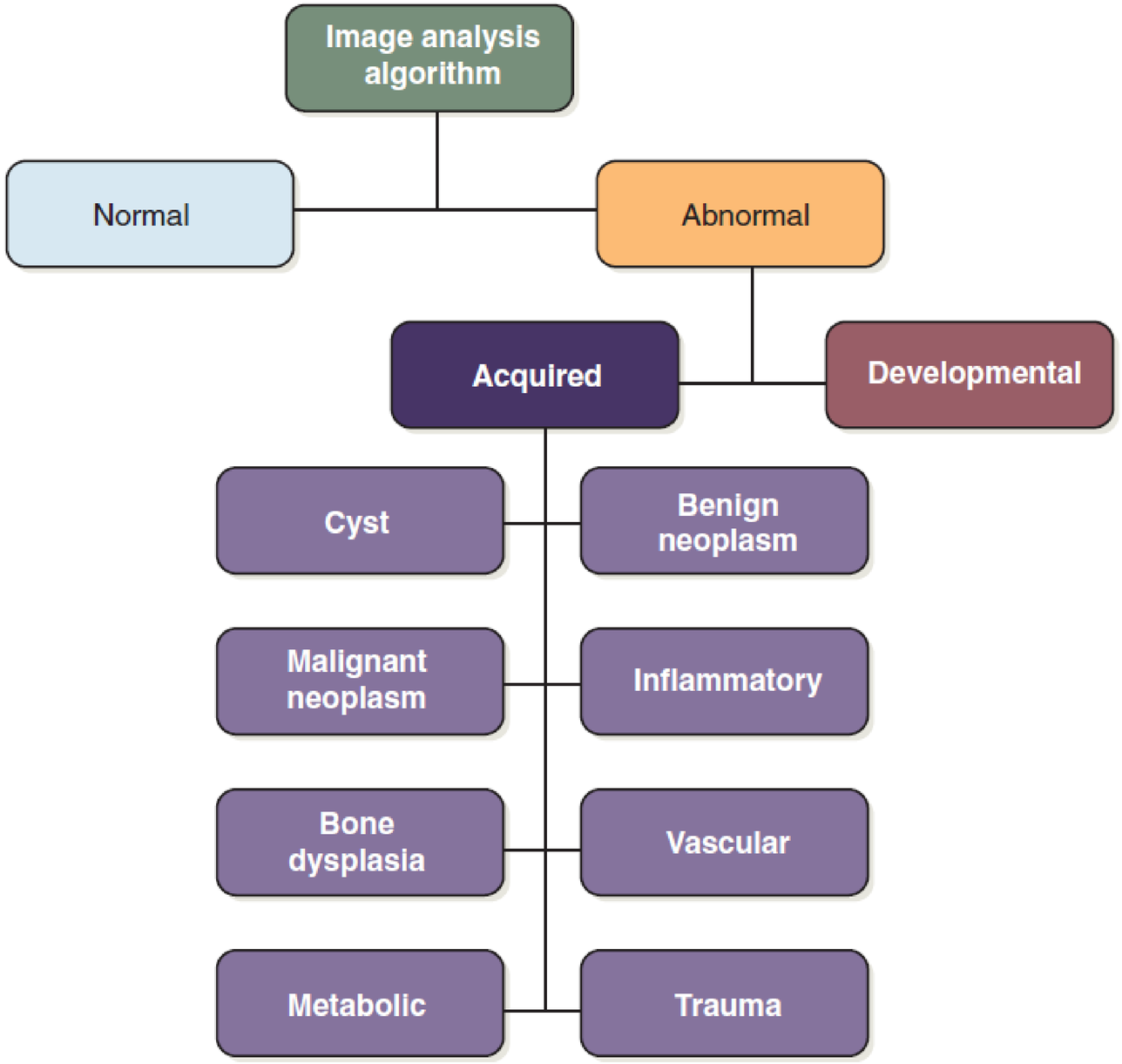
Effect on surrounding structure

Surrounding teeth: root resorption, teeth displacement

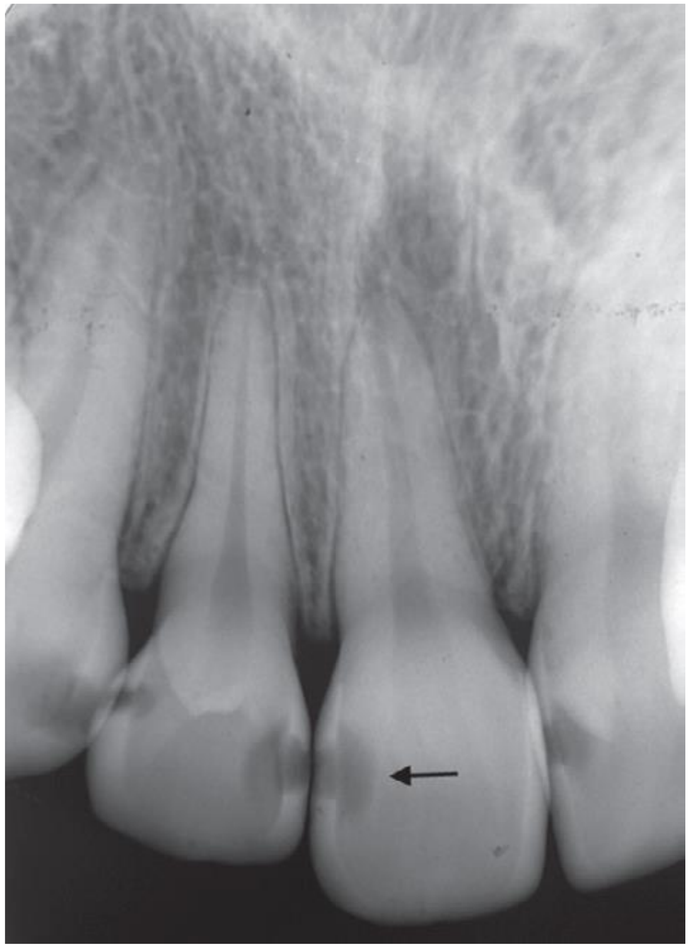
Surrounding bone: sclerosis

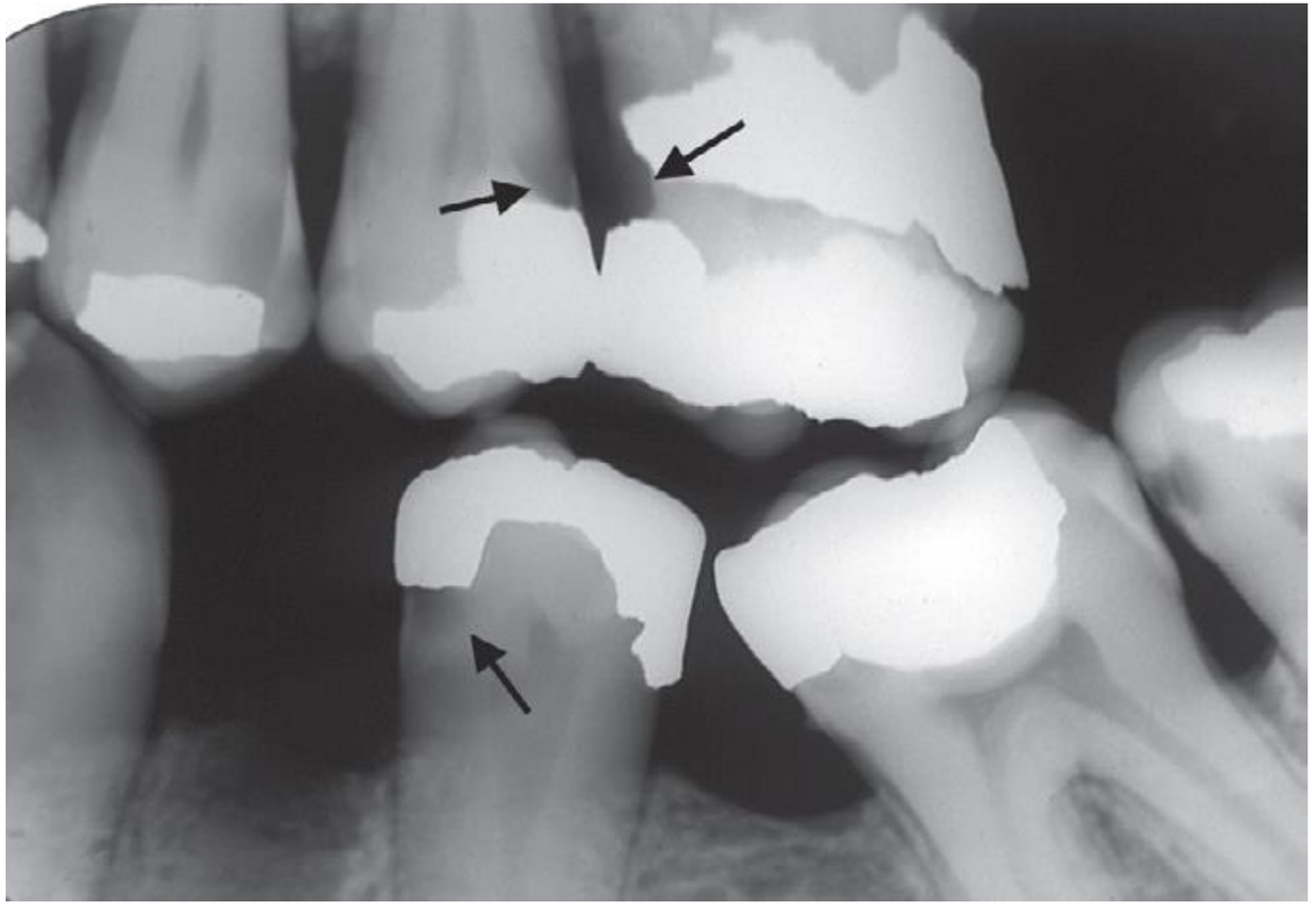
Inferior alveolar nerve: any displacement? Widening?

Determine the differential diagnosis for your lesion

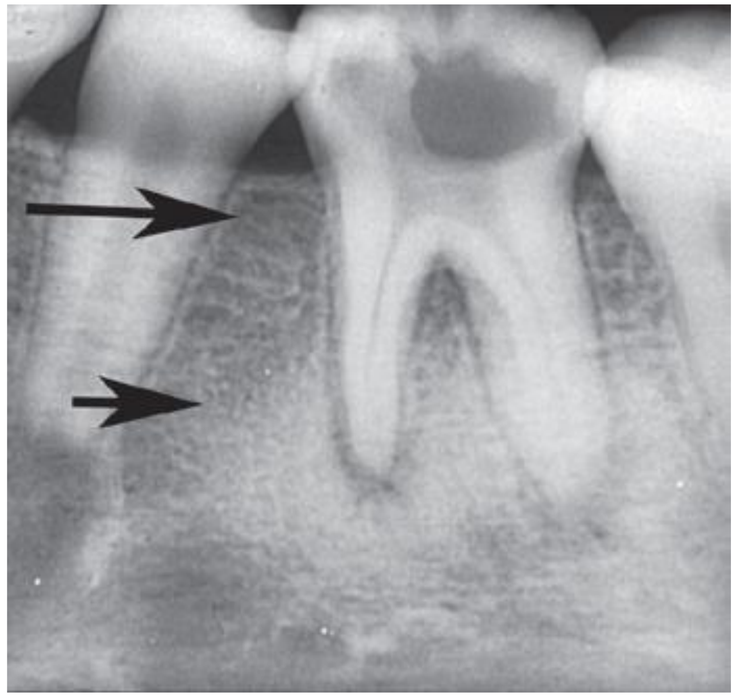


Caries

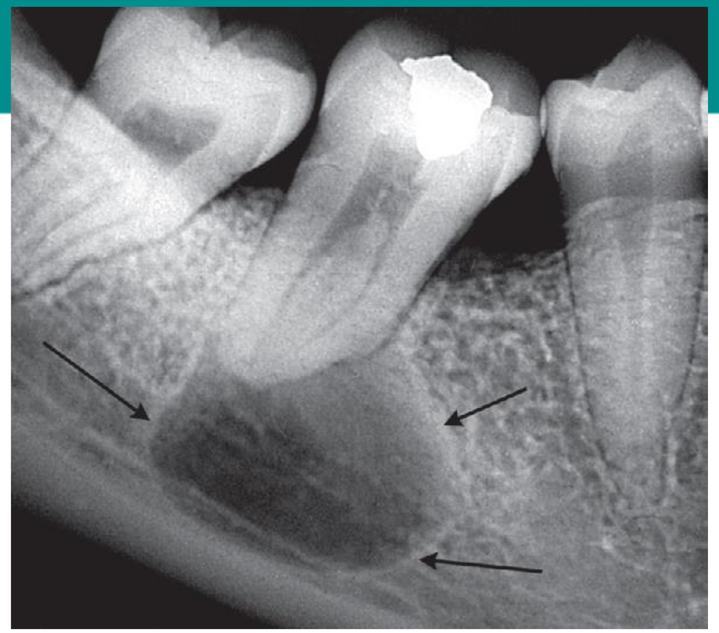




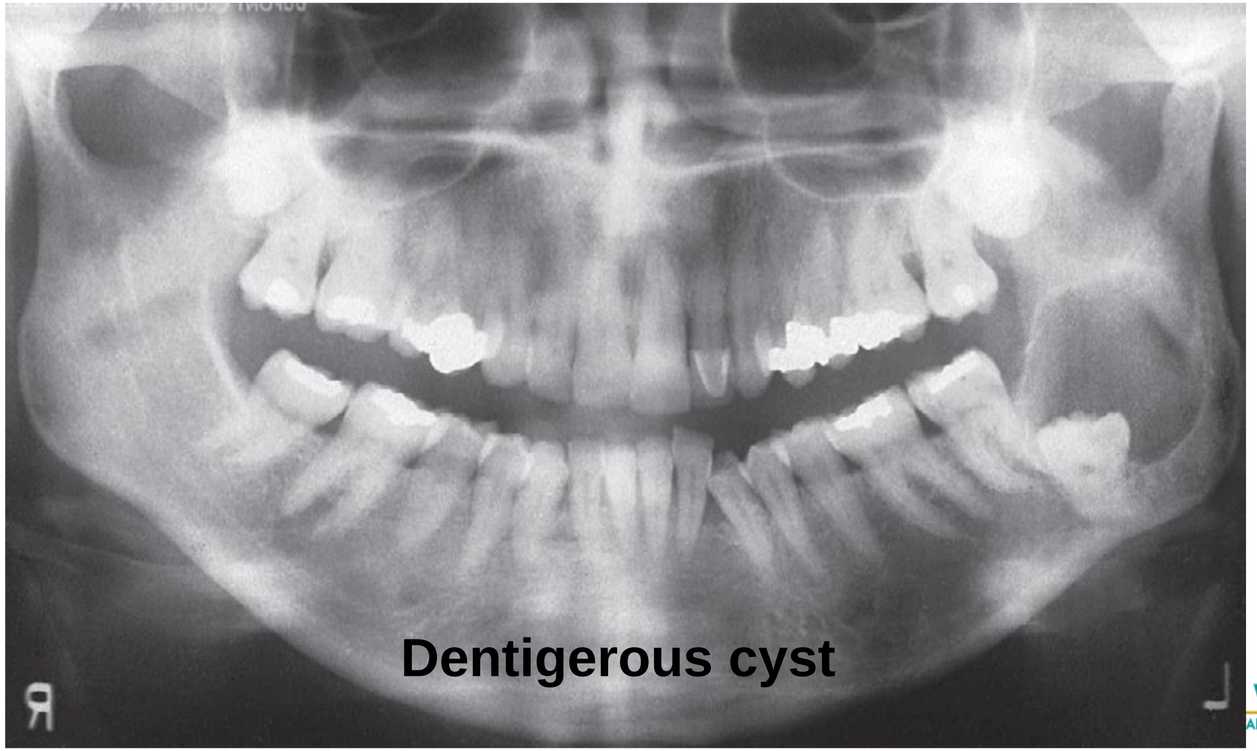
Inflammatory lesions



Cyst



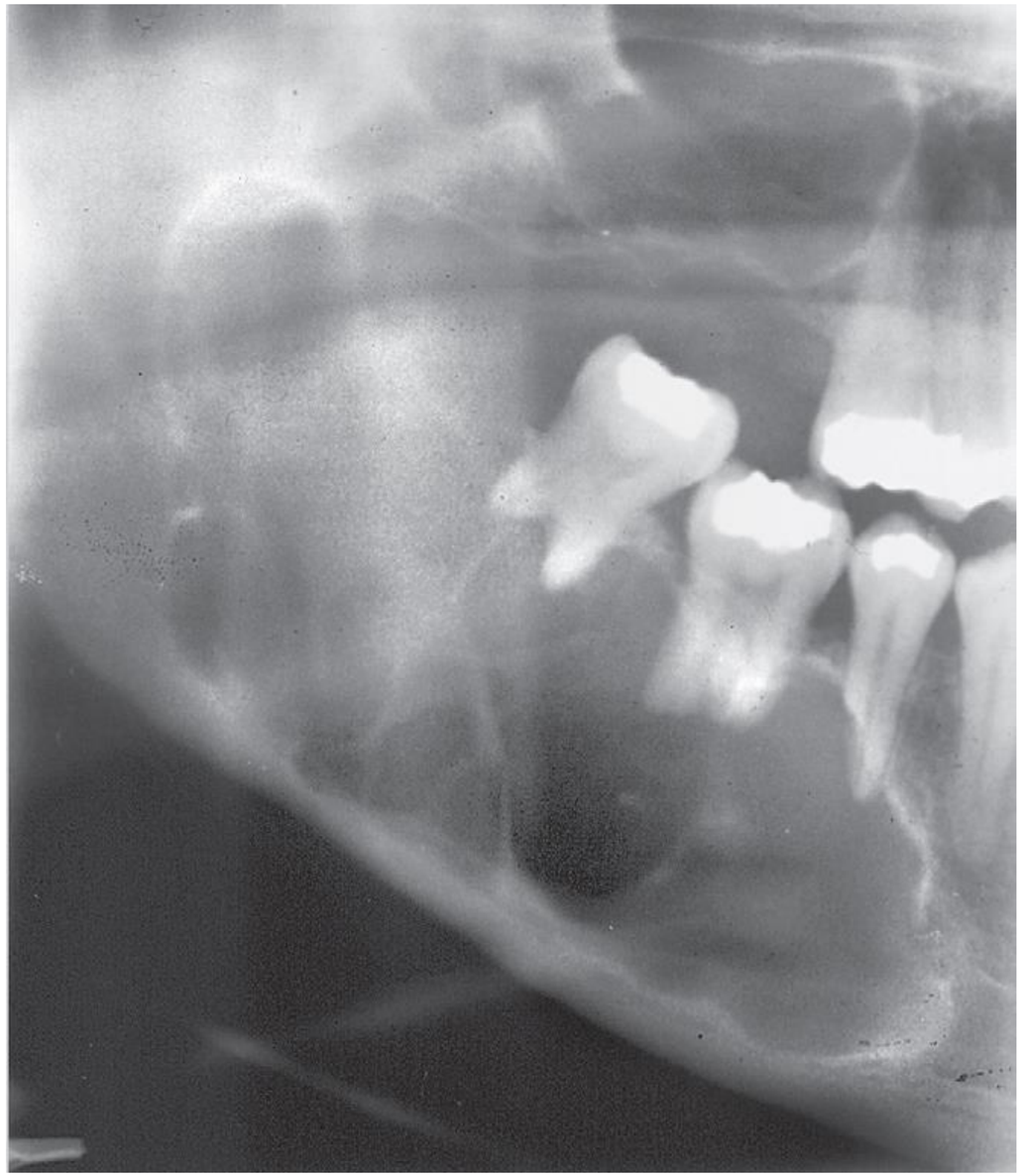
Radicular cyst



Dentigerous cyst

Benign lesions

- **Ameloblastoma**



AI based diagnosis

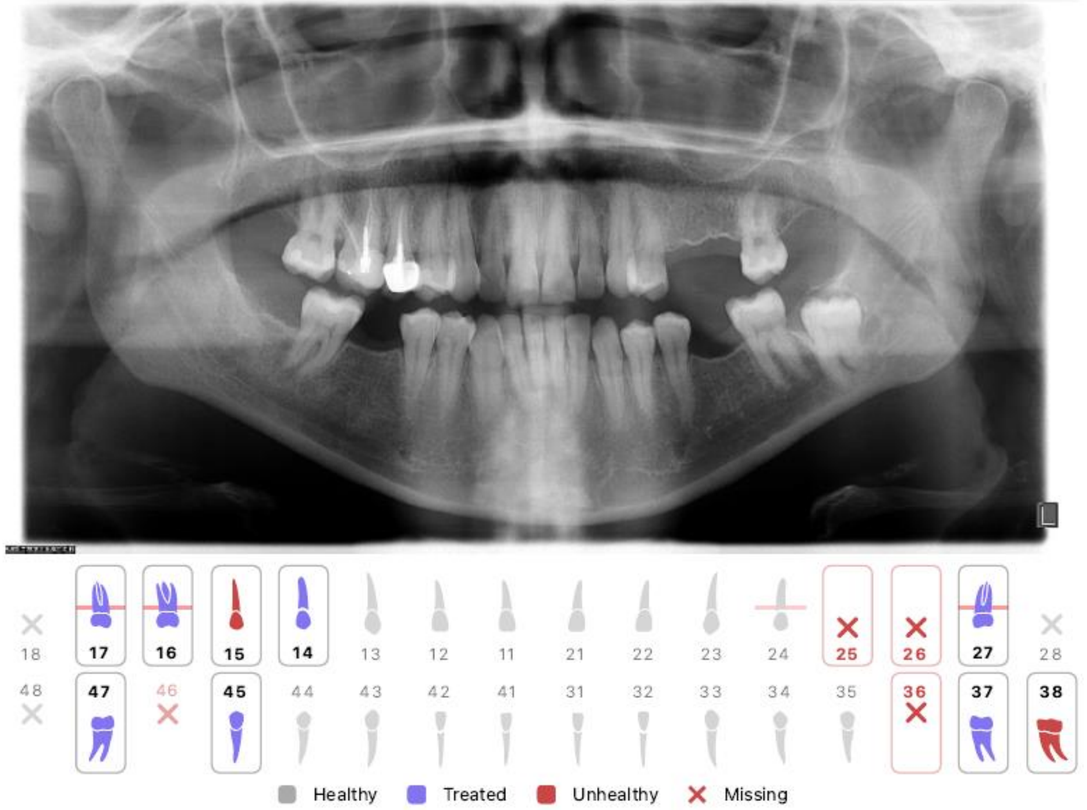
Diagnocat

Panoramic analysis: Teeth 17 — 47

22.02.2022

Patient name: Smith Ion | Patient ID: 783578 | Age: 1

Date of birth: 27/08/2020 | Scan date: 04/12/2020 | Gender: Male



Tooth 17 Periodontal bone loss, Filling.

deep cleaning procedure

Tooth 16 Periodontal bone loss, Filling, Canal filling, Post.

Tooth 15 Artificial crown, Canal filling, Post, Periapical radiolucency.

Tooth 14 Filling, Artificial crown.

Tooth 25 Missing.

Tooth 26 Missing.

Tooth 27 Periodontal bone loss, Filling.

Tooth 38 Impaction.

Tooth 37 Filling.

Tooth 36 Missing.

Tooth 45 Filling.

Tooth 47 Filling.

- When to prescribe a pano?
- USA Guideline: ADA/FDA patient selection
- https://www.fda.gov/radiation-emitting-products/medical-x-ray-imaging/selection-patients-dental-radiographic-examinations
- UK Guideline: FGDP Selection Criteria
- https://cgdent.uk/wp-content/uploads/2021/08/FGDP-SCDR-ALL-Web.pdf

New patient: bitewing is more superior for common dental problems

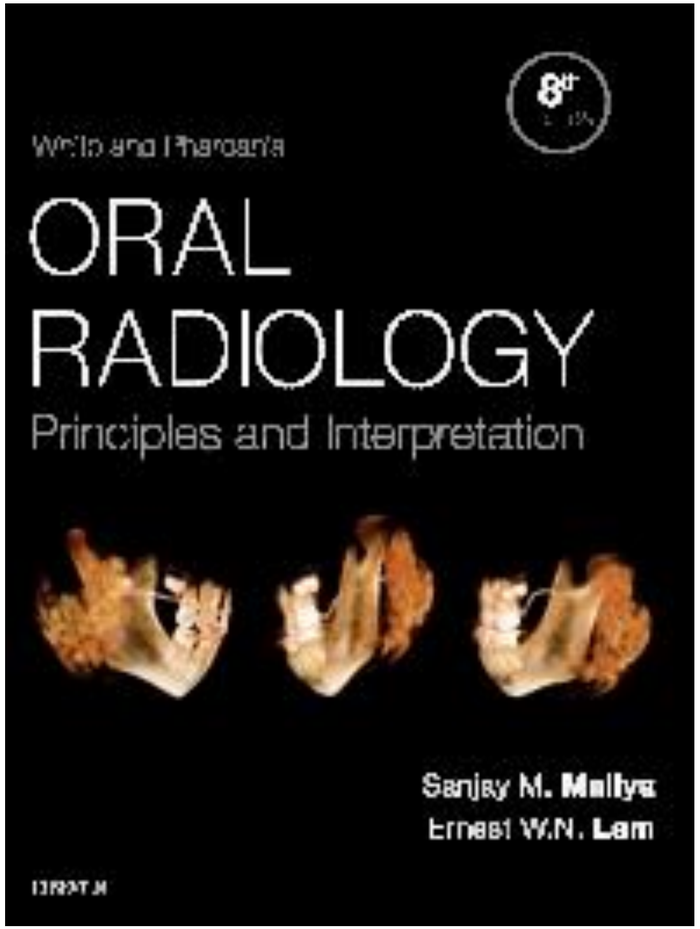
Not as a *screening for all patients*

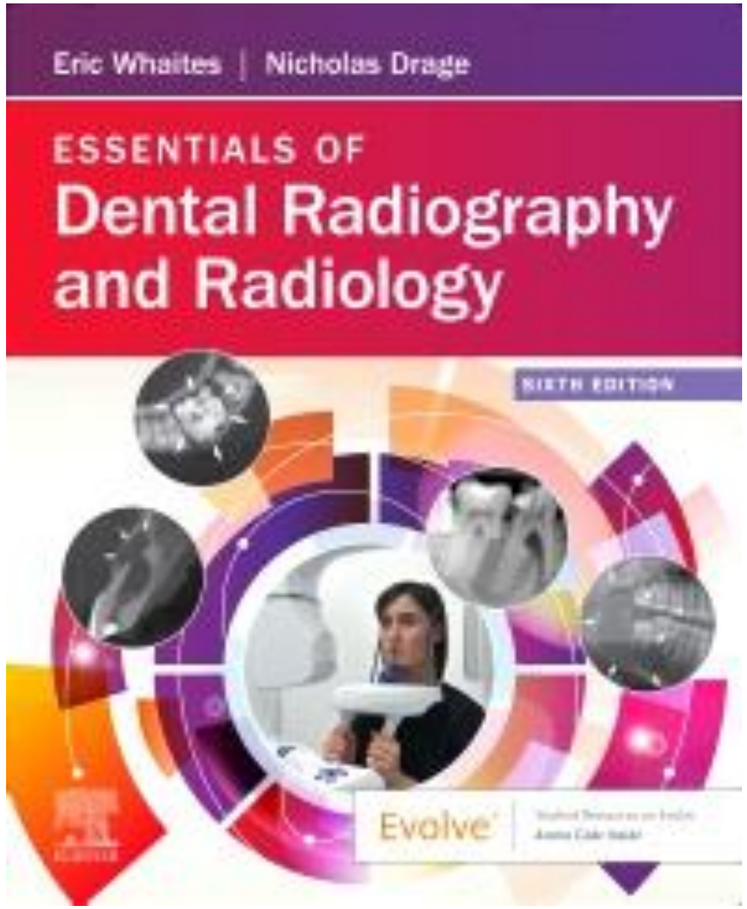
Clinical examination, history taking prior prescribing a pano

Suggested patient selection for panoramic radiograph

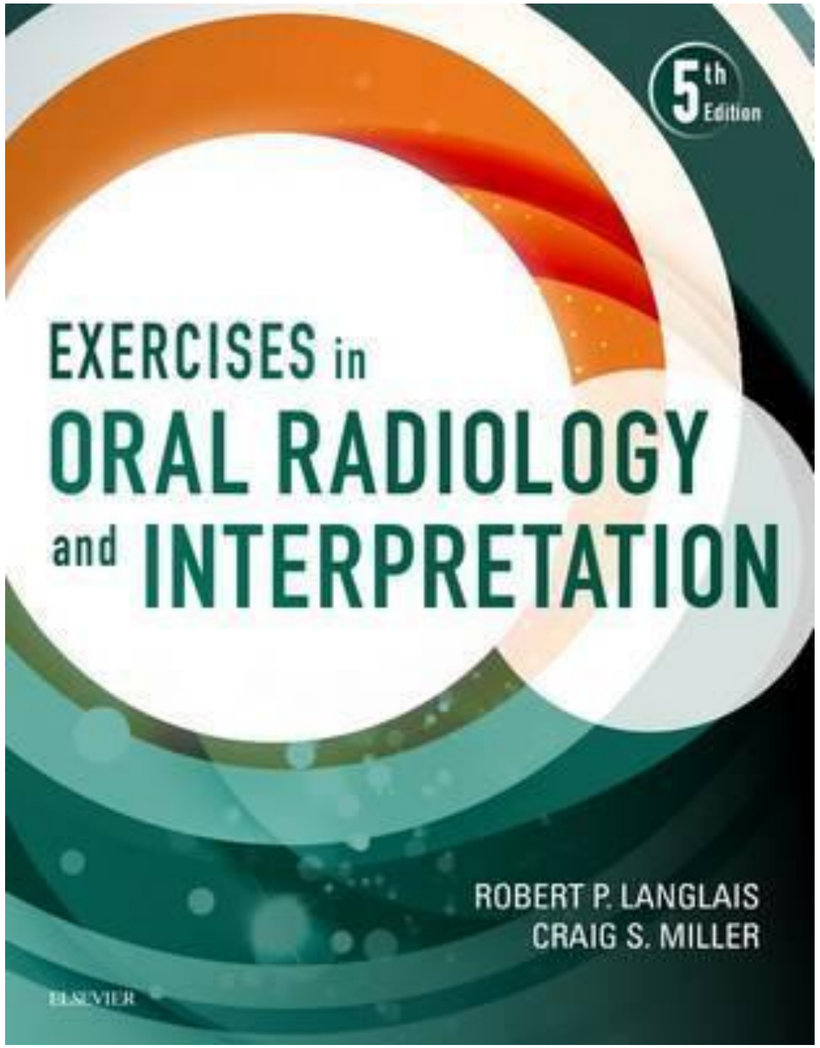
- For bony lesions larger than intraoral radiograph area
- Grossly decayed, multiple caries
- Prior to third molar extraction, *but not for routine to all patients*
- Pre-orthodontic assessment
- Justification with signs and symptoms

Suggested readings





- The two main textbooks



- Exercises in Oral Radiology and Interpretation
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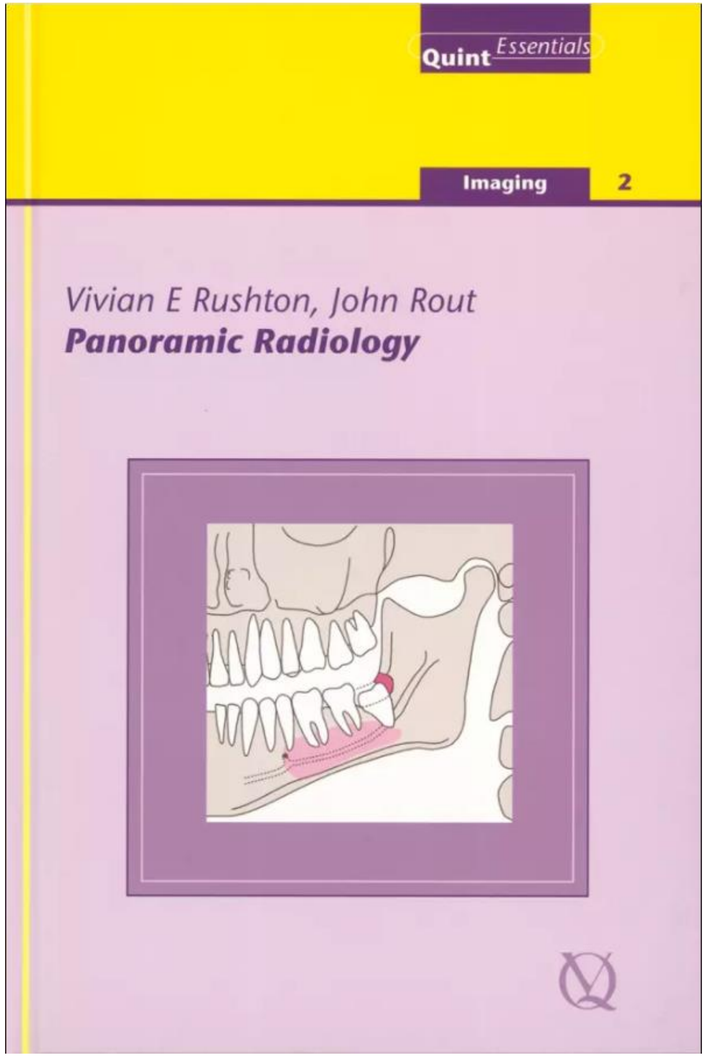
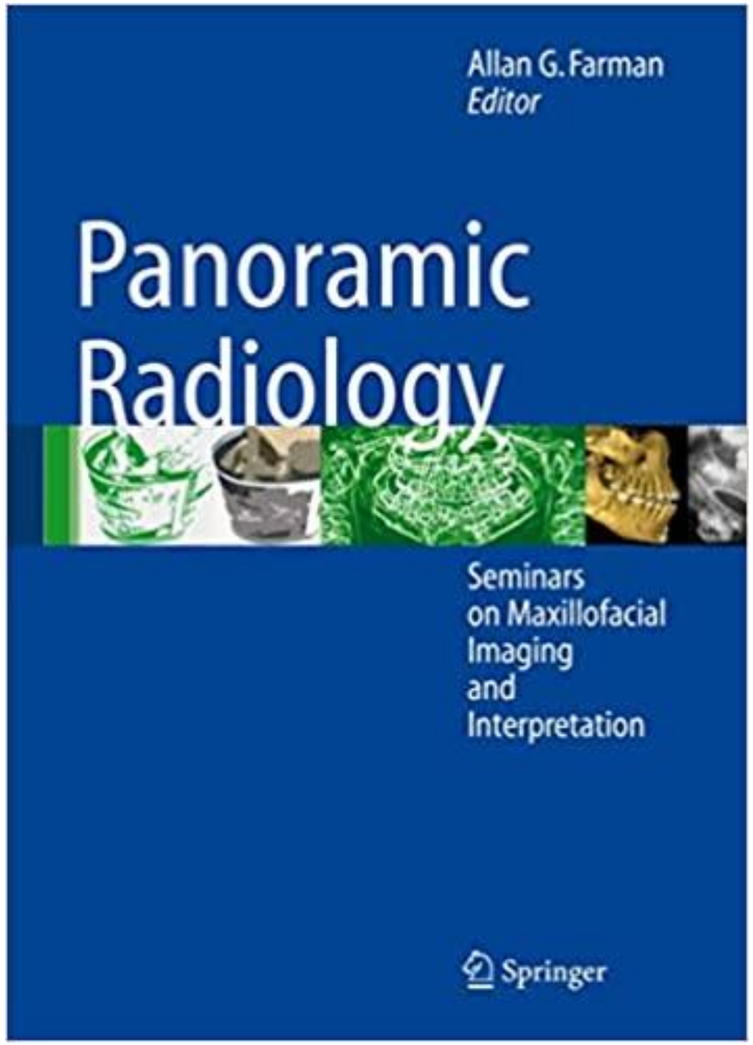


- Rushton, Vivian E. / Rout, John
- Panoramic Radiology
- Series: QuintEssentials of Dental Practice, Volume 20
- 1st Edition 2006
- Book
- Hardcover, 160 pages, 131 illus
- Language: English
- Category: Radiology and Photography

- Stock No.: 5391
- ISBN 978-1-85097-080-4
- QP United Kingdom



- Panoramic Radiology
- Seminars on Maxillofacial Imaging and Interpretation
- Allan G. Farman 2007
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